In This Issue: Electric Railway Problems in the West

JOURNAL OF ELECTRICITY

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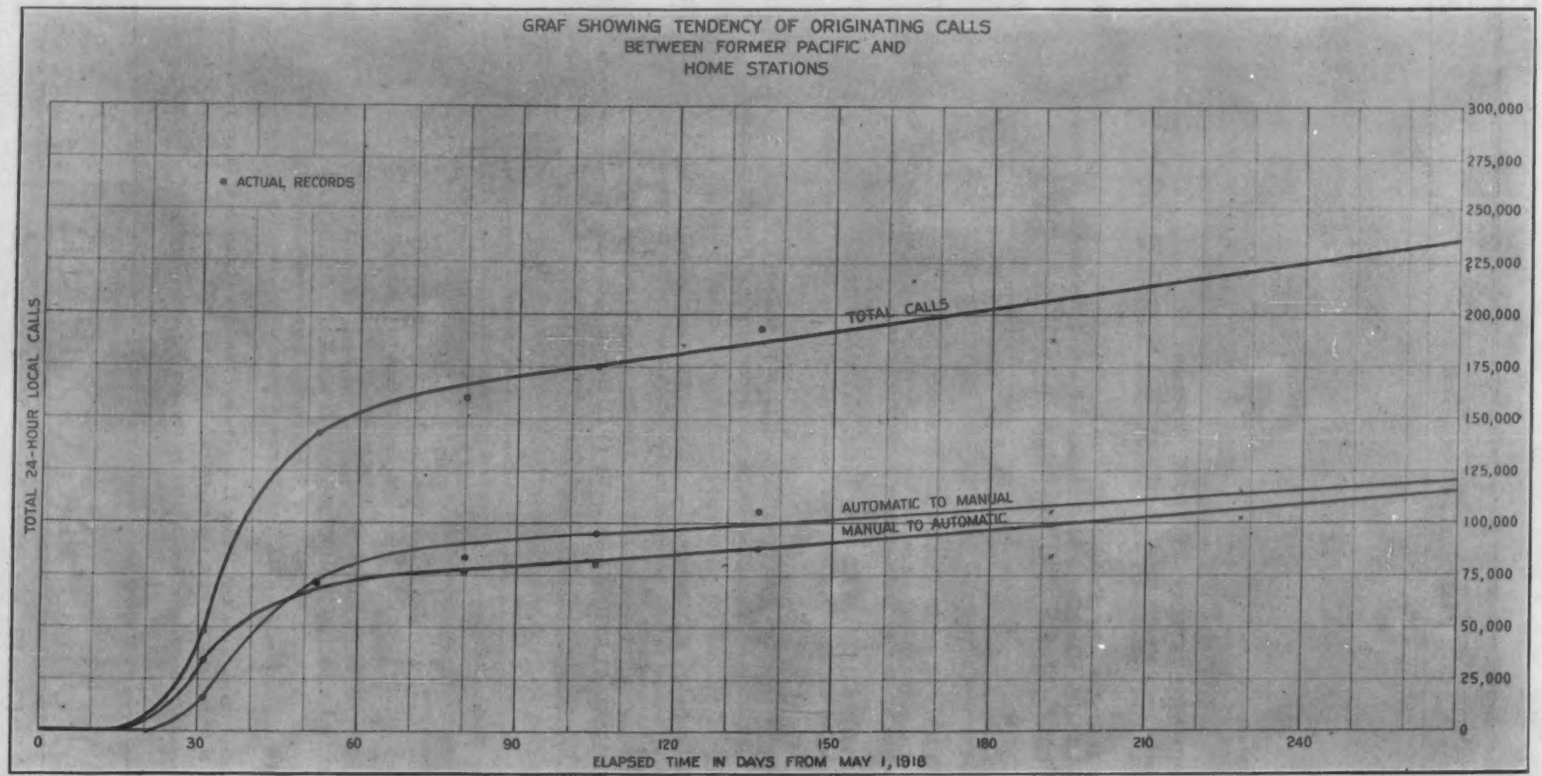

ANOTHER WORLD'S RECORD IN THE METHOD ELECTRICAL AT LOS ANGELES

The largest and most extensive automatic system of telephones in the world, situated in a city that had the largest density of telephone installation per capita in the world has now been thrown into operation and its activities coordinated with universal telephone service available throughout the entire United States. So accurate proved the forecasting of the increase in telephone service that the curve shown above, projected from observations up to the 192nd day, was found to tally exactly on the 228th day when an actual count was made. Such achievements as the great interconnection at Los Angeles in telephone accomplishment but again establish the supremacy of the method electrical in the West where electricity is used per capita of population to a degree not even approached by any other district in the world.

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JOURNAL OF ELECTRICITY

DEVOTED TO THE UPBUILDING OF THE ELECTRICAL INDUSTRY IN THE WEST AND IN THE COUNTRIES BORDERING THE GREAT PACIFIC

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The League of Nations

As in the business world true cooperation demands a unification and coordination of service, merchandising methods and ethical ideas that business may the better serve the demands of human society, so in the formation of the League of Nations we must anticipate that the same refining process will be necessary — but the vast possibilities such a move offers for the forwarding of the permanent peace and prosperity of the world as a unit so overshadow all arguments that may be advanced against it as to convince thoughtful men that the one awe-inspiring and enduring outcome of this terrible experience through which the entire world has just passed is this possible accomplishment of a League of Nations based on a longing in the human breast so sacred and almost so unbelievable of attainment that one almost dare not utter it, yet now it appears within the grasp of possibility.

A New Record in Telephone Development

In the merging of the largest automatic system of telephones in the world, the problem so successfully solved at Los Angeles establishes a new record for which the West is justly proud.

The continual expansion of the universal service idea, so well known as the ideal toward which the Bell system has for years bent its efforts, month by month reveals new wonders in progress.

It was back in the early nineties that the Pacific Coast contributed the final knock-out blow to the former magnetic ring-in system and made possible the calling of the operator by simply taking the receiver off the hook. There followed extensions and improvements in other lines until at the Panama-Pacific International Exposition in 1915 the great transcontinental trunk lines were opened with demonstrations between San Francisco and New York. And finally, just prior to the entrance of the United States into the world war, Secretary Daniels at his desk in Washington was able to communicate intelligence to the Eiffel Tower in Paris and to the giant station in the Hawaiian Islands, from where it is reported the effect was registered in far-off Japan.

Coming back to telephone development in the West, it is generally understood that nowhere else in the world are telephone installations more intensive than at San Francisco and Los Angeles.

Only those who have been abroad and experienced the vast difference between the accuracy and rapidity of service connection prevailing in this country and foreign countries can appreciate the daily blessings enjoyed by its citizenry.

While the expenditure of the million and one-quarter dollars in Los Angeles in addition to considerable increases in operating costs has been made without in any manner raising the telephone rates prevailing prior to the interconnection, the breadth of service has veen vastly widened—in fact, a service that now, less than ten months after the interconnection, will total over a quarter of a million additional calls per day, has already developed.

The article of Mr. Wiseman appearing elsewhere in this issue, on the remarkable interconnection feat at Los Angeles, will unquestionably be read with great interest and the Bell system as a whole may well be congratulated upon the accomplishments of this new engineering advance in the West.

A New Advance in Electro-Chemistry

It is with unusual gratification that word has been received concerning Western genius again receiving world-wide recognition. Dr. Frederick G. Cottrell, known to the West as the inventor of a process for electrostatic dust precipitation, has recently been awarded the Perkin medal for distinguished service in chemical research. In accepting the honor Dr. Cottrell, who is now chief metallurgist of the U. S. Bureau of Mines, outlined some interesting investigations that are now being undertaken under his direction that will in all probability result in a real revolution in the fundamental industries of the country—namely, the production of helium and oxygen by vastly improved economic processes. Helium is a non-inflammable gas heretofore not available in large quantities, which it is proposed to use in balloons, and which it is anticipated may make transportation by dirigible a fairly safe proposition. Oxygen on the other hand enters so largely into countless industrial processes as to make its economic production a matter of prime importance in the industrial life of the nation. This advance in electro-chemic research will as a consequence be watched with unusual interest from many quarters.

It is interesting to briefly review the great accomplishments already attained by the so-called

Cottrell process of dust precipitation. Due to the discovery of Dr. Cottrell that small particles in chimney gases exposed to a strong magnetic field become electrostatically charged and consequently travel at right angles to the movement of the chimney gases as a whole, a practical application has been made by him which is accomplishing vast economic savings.

One of the interesting features of the process is that, although developed solely to prevent a nuisance, it frequently proves most profitable financially. For instance, it is stated on good authority that a copper-smelting company installed a precipitating plant at a cost of $113,900. The operating expenses were $14,600 per year but the copper-dust collected proved to have a value of $180,018.

Such achievements as this merit the praise and admiration of all beholders and the West is proud to claim this noted inventor among its builders.

The Recovery of Business

An unusually interesting deduction may be made from some facts in regard to the reconstruction period during and after our Civil War that have recently been compiled by a prominent manufacturer of electric appliances. These, if carefully interpreted, may aid in casting considerable light on the present status of business and some estimate of the relationship of business volume, cost of labor and general prosperity forecasted. From 1860 to 1865 the business of the North was as prosperous as business in this country from 1914 up to the present time. During both periods business operated on a rising market. From 1865 to 1873, American business operating on a falling market, enjoyed the greatest prosperity it had ever experienced up to that time. At the conclusion of the Civil War prices began to decline and wages continued to increase for seven years after the conclusion of the war. In the period from 1860 to 1865, and from then on there was an almost uninterrupted decline, the index number for 1880 standing at only 4% above the level for 1860. Wages on the other hand rose more slowly during the war period and continued to rise generally until July, 1872, seven years after prices had begun the long decline. The margin of gains for the workers, the net increase in real wages, maintained at the close of the 20-year period, can be roughly measured by the indices, which show a gross gain of 38% in wages over the 1860 level, against a net increase of 4% in wholesale prices.

It is particularly illuminating to note carefully the above statement that although operating on a falling market from 1865 to 1873 yet American business enjoyed the greatest prosperity ever experienced up to that time. If we carefully examine into the industrial and technical progress of that day the real reason for this may be easily found. New inventions and new economies were brought to light on all sides and the technical brain power exerted during the stress of war bore abundant fruitage on every side immediately following the war period.

And unquestionably the period of world development now ahead will experience a thrill and advance never before accomplished in the world's history, due in large measure to this same cause. Already the forewarning is heard in many quarters. The recent announcement by the Bureau of Mines of possible vast economic reductions in cost of oxygen production is but one instance. On all sides new uses and new processes for fuel manufacture are heard each day. The aeroplane, with the thirty thousand young brains trained in its service, means new fields of usefulness that must imprint its influence upon the next score of years ahead. Telegraphy, telephony and radio service are in new and interesting phases of advancement day by day. Ship building and newly applied arts such as electro welding are working new wonders. And the beginning is only here. A year or so from now, when the splendid inventive power of this nation is again fully relaxed into peaceful channels of application, economic savings and new processes of manufacture will be brought to light never before thought possible of accomplishment. And this inventive era ahead is but one phase of the many good things in store. Indeed, the general business outlook is more promising for American enterprise from many new points than ever before experienced in its eventful history. And in all this promise of good things electricity and its manifold uses will play the major role.

The Returned Soldier Problem

The electrical industry in the West finds itself confronted with the returned soldier problem to an enlarged degree. Thousands of young men who have visited the West and have been stationed at the various camps in this attractive section of the nation have become enamored with the enthusiasm, newness of life and future possibilities of this section. In one city alone three thousand discharged soldiers, formerly residents of other states, have literally set themselves down in this particular city and decided that the place looks good to them. While this choice of residence is most complimentary to the West it at the same time has placed a burden upon the business life of the community that for some months to come will not prove easy to bear.

All agree that every possible effort must be made at once to assist our splendid young men, who have so wonderfully met the hours of crisis in our national life, in giving to them the very best that we have to offer.

But it is for the greater good to all that sane and thoughtful choice be used in starting again the wheels of industry to meet peace time conditions. In view of the increasing congestion in the business and industrial life of the West, due to such large numbers of men appearing in fields where employment should first be given to the men who here left their positions to go to war, would it not be wise to spread the idea that every man should upon being discharged seek first the former city and place of occupation? A few months will work wonders in readjustment and this seems the most direct method of bringing about the quickest results, and a method that will involve the least confusion and loss of time in readjustment.

One-Man Safety Cars for Electric Railways

The electric street railway industry for several years past has been confronted with disheartening problems arising from unforeseen competition, such as the jitney, a reduction of revenue due to a change in riding habits of persons acquiring automobiles, frequently referred to as "competition of the private automobile," the failure of light feeder and pioneer lines to develop traffic in keeping with original predictions when projected, and the inability to secure general public recognition that five cent fares in the face of increased cost of labor and materials, longer hauls and better service, must give way in many cases to radical increase.

From these adversities have sprung new theories and practices which in the ultimate will tend to strengthen the position of the electric railway industry. Due to the sentimental nickel standard, few electric railways have been able to pay dividends, to say nothing of the inability to handle the subject of depreciation and reserves which would permit the needed modernization of much equipment which would result in many economies. The exigencies of the war period have seen public utility regulatory bodies over the entire country granting fare increases in many cities, ranging from 1c to 5c above the sentimental nickel standard. In many hearings in such matters it has been emphasized that electric street railway systems are without parallel in the economical and efficient transportation of large numbers of people and with a minimum occupancy of street area per passenger foot and maximum safety of operation. In some cases such as the classic Bay State Railway decision of the Massachusetts Public Utility Commission, the demand of the utility for higher fares was met by the suggestion of remonstrants that operating costs might be materially reduced and service improved by the use of the modern light weight one-man safety car. The importance of this case to the public and to the electric railway industry prompts us to publish the decision in this issue on page 225.

Probably no improvement in electric railway car equipment introduced since the "Pay as You Enter" principle holds so much promise to the public and the railroad alike. The cars are extremely light, weighing from 12,000 to 15,000 lbs. fully equipped, and seating from 32 to 40 people. They are equipped with ball or roller bearings throughout and extremely light but sturdy motor and air brake equipment. The controllers are equipped with "dead man" handle features which insure absolute safety of operation if the motorman becomes incapacitated as the car is brought to an emergency stop, the power being thrown off and air on while tracks are sanded and car doors opened at front and rear end if desired.

Some of the outstanding advantages of this class of equipment are as follows: With practically the same operating expenses, the railroad may operate twice the number of cars over a given line, thereby reducing the headway one-half. It has been demonstrated in many instances that reducing the time interval between cars increases the riding habit of the public.

The power, labor and maintenance per car mile is reduced as compared with older types of cars. The track maintenance, as well as the weight of rails, for light traffic feeder line are reduced. Since the cars are extremely light, they can be handled easier and faster schedule maintained more safely than with the old type equipment. Where the public has become accustomed to the car there is a unanimous opinion that the car is "getting there." This faster handling of the car tends to overcome the impatience of the modern traveling public which is inclined to the opinion in some cases that a five cent fare should give them the equivalent of individual taxi service.

This type of car is now used on over 130 railways throughout the country and has been endorsed for use, when suitable, by the most conservative public service commissions, including Wisconsin, Massachusetts, New York, as well as California. This car was primarily adopted by the Stone & Webster Corporation for its various electric railway properties, including Seattle, Tacoma, and Fort Worth. It is not, however, to be considered as a panacea for all electric railway traffic difficulties, and it should be fairly stated that this type of car is intended solely for light and medium traffic lines. Some operating men who have had experience with the equipment contend that the car should be generally used on many city systems in towns ranging from 50,000 to 75,000 inhabitants.

No other single subject pertaining to electric street railway equipment and operating problems has received more careful treatment than this during the past three years and to parties, whether of the public, labor or railway fraternity, earnestly desiring facts prepared judicially, we commend a careful study of the Massachusetts decision referred to above.

THE NEW JOURNAL SERVICE: What do you know about electricity? Can you explain simple circuits, losses, power and efficiency, wiring calculations, how generators and motors are installed, how they work, what efficiency means and how to calculate it, and how current for electric lighting and heating is estimated? In the issue of the Journal of Electricity for March 15, 1919, will be initiated the text for a correspondence course under the direction of the Extension Division of the University of California, prepared by H. H. Bliss, in charge of technical instruction. In previous years over a thousand have sought aid of this sort from the University. The former work has been revised and the Journal of Electricity is assisting in forwarding this splendid new work in every way possible. The movement also has the unanimous endorsement of the Advisory Committee of the California Electrical Cooperative Campaign. Spread the news everywhere to linemen, operators, telephone workers, electrical contractors and dealers, jobber salesmen — in fact, everyone interested in perfecting his efficiency in the elementary technical grasp of matters electrical. Full particulars may be gotten by addressing either the Journal of Electricity or the Extension Division, University of California, Berkeley.

UNIFICATION OF TELEPHONE SYSTEMS

BY D. E. WISEMAN

(The unification of the manual and automatic telephone systems in Los Angeles is remarkable from many standpoints. The two systems had been operating side by side for over 16 years, the automatic system was the largest of its type in the country and Los Angeles had more telephones per capita than any other city in the world. The following article formed the substance of an address delivered before the San Francisco Section A. I. E. E. by the author, who is plant engineer with the Pacific Telephone & Telegraph Company, with headquarters at San Francisco.—The Editor.)

In telephone engineering and the resultant physical and economic accomplishment, June 1, 1918 figures prominently, for on that date the formal union of the Bell Manual telephone system operated by The Pacific Telephone and Telegraph Company, and the Automatic Electric system operated by the Home Telephone and Telegraph Company in the city of Los Angeles, was effected under the management of the newly created Southern California Telephone Company, giving to every telephone user in that area a unified and unrestricted exchange telephone

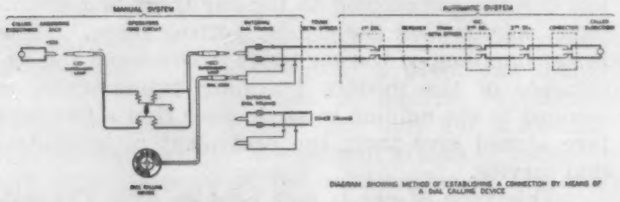


DIAGRAM SHOWING METHOD OF ESTABLISHING A CONNECTION BY MEANS OF A DIAL CALLING DEVICE

FROM MANUAL TO AUTOMATIC

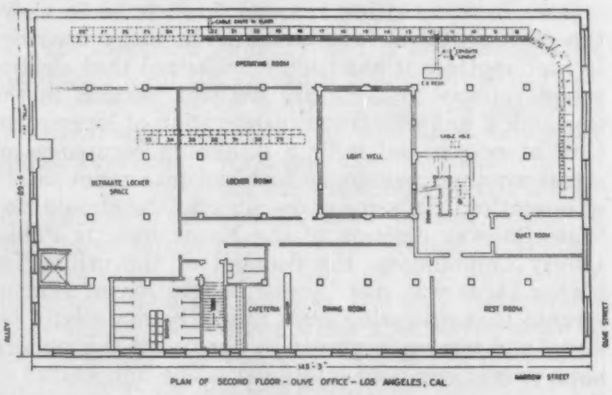
Calls from manual stations are operated by removing the receiver which calls the operator who obtains the number called for and operates the dial accordingly, thereby completing the connection direct.

service and universal service over toll trunk lines to some eleven million telephones throughout the United States. Consolidations of this character have been made prior to this date but involving relatively small volumes of traffic and simple operating methods, so that there were no records of actual performance or established engineering practice to serve as a precedent and guide for determining the effect of and the physical requirements necessitated by the sudden release of two large, distinct and separately bound volumes of traffic into a common channel.

Because of the novel operating and construction methods and the speculative possibilities involved in the important pioneering work of welding these fundamentally different telephone switching systems into a single eighteen-million dollar plant serving 129,000 stations, a semi-technical summary of the events has been prepared for general information and is presented herewith.

Conditions Leading Up to Consolidation

A brief reference to the conditions which brought about the consolidation will be made in order to better understand the problems that confronted the two competing telephone companies and their subscribers. Believing that competition instead of control was the automatic remedy to apply to public utilities, the city of Los Angeles invited telephone competition about sixteen years ago and then struggled along with her business firms and many of her residents paying two telephone bills for a divided and what proved to be an unsatisfactory telephone service. This condition was continued until the year 1916, when the public decided by popular vote to bring about an end to dual telephone service. Negotiations were begun and various proposals were considered by all concerned in an effort to avoid any waste or arbitrary measures. A plan was finally accepted for the organization of a local telephone company, which was to purchase the properties of the existing operating companies and unify the service, continuing with the equipments then in plant and giving the right to the telephone users to determine for themselves whether they would retain their automatic stations or manual stations. War conditions imposed restrictions in the conservation of materials and men for such projects and called for a careful weighing of the expected benefits and expenditures of materials and labor.



PLAN OF SECOND FLOOR - OLIVE OFFICE - LOS ANGELES, CAL

THE OLIVE OFFICE

The largest single project in the entire undertaking was the design and manufacture of the 66 position special tandem switchboard for the translation of calls from automatic stations to manual stations in the down town area. The diagram shows the second floor with locker rooms, cafeteria, etc.

With this clear understanding of the requirements, a joint committee of engineering representatives was appointed to determine the methods for the physical joining of the two systems. As a result of these efforts, a fundamental plan, together with preliminary estimates of cost, was submitted and formally approved by the city of Los Angeles, the Railroad Commission of the State of California and by the Attorney General for the Federal Government, and on May 1, 1917, formal authorization was given to proceed with the project.

Differences in Equipment and Methods

In order to picture the plants as they existed prior to the consolidation, I shall refer briefly to the physical properties and the operating methods of the two systems.

As at May 1, 1917, the Pacific Company's exchange consisted of its standard outside plant and station equipment and nine manually operated cen-

tral offices serving about 69,000 stations. Bell equipment was used in units having a capacity of 9,600 multiple lines. Telephone connections were established generally by the calling subscriber removing the receiver from the switch hook, causing a light to appear before an answering "A" operator, who upon receiving a request for a particular number cut-in on an order wire to the particular switchboard unit in the district, indicated by the prefix of the number called for. An operator at the distant switchboard unit, assigned a trunk over this order wire to the calling "A" operator and completed the connection by plugging into the called-for subscriber's multiple.

The former Home Company operated an automatic exchange including a parallel and similarly constructed outside plant and 14 offices serving a total of approximately 60,000 stations. About 35,000 stations were equipped with dials and approximately 25,000 manual stations operated from private branch exchanges and as public pay stations. The lines from the manual stations terminated on a 45 position manual switchboard in the Olive office. Calls from automatic stations to automatic stations were made by dialing five or six digits, as required, to reach the particular district and individual subscriber. In capacity the former Home plant was one of the largest and probably the most successfully operated of any automatic system installed in the United States or abroad. Home Company private branch exchange subscribers were reached by dialing the private branch exchange operator, who completed the connection. Calls outgoing from private branch exchange subscribers were trunked to the manual transfer board above mentioned, the calls coming in on an automatic trunk distributor which placed each line lamp signal before a non-busy operator. The operator upon taking up these connections would complete the call direct if to another private branch exchange station through the subscriber's multiple or dial the number required, if an automatic station was wanted.

Special Problems

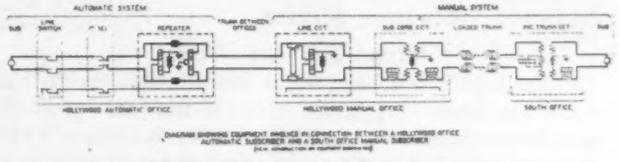
Los Angeles has had the distinction of having more telephones per capita than any other city in the world and is now very close to the top of the list. This general usage is reflected in the number of calls originating in each system, as shown by the records of traffic. The approximate number of daily average calls originating in the former Pacific plant and Home plant was in the vicinity of 430,000 and 420,000 respectively.

The engineering problems demanded, therefore: A reasonably close approximation of the volume of existing and added traffic which could be expected to flow between the groups of stations of the various districts of the two plants; a determination of the most direct and economical routing of such calls based on efficient operating methods and the use of existing facilities; and the design and development of an inter-unit trunking plant and switching circuits necessary to maintain the commercial standards for transmission and supervision between the two systems regardless of the mechanical, electrical and operating inequalities. Visual and audible signals peculiar to the separate systems required for supervisory purposes needed to be synchronized or harmonized.

It is obvious that a great many plans and combinations of plans for unification were developed in sufficient detail to determine their relative capital and operating costs and advantages and disadvantages. The plan in principle that was adopted for handling the inter-office traffic between the systems was to operate all existing offices as units of the complete exchange and route the new automatic or manual trunks of each office into the adjacent office of the opposite system, where the connection could be completed by the most direct method and route.

Schedule of Work

Having referred to the facts that were most vital in shaping the project, I should like to outline the organization and schedule of work involved in the construction program estimated to cost one and



CALLING FROM AN AUTOMATIC STATION

Calls from automatic subscribers to manual stations are obtained by operating the digit numbered "9" on the dial. This carries the connection through to the operator in the adjacent branch office who asks for the number desired and then passes the call to a completing trunk operator in the district of the called-for party.

one-quarter millions of dollars. Every reasonable effort was demanded to bring about a unification of the properties without waste of time, and accordingly a complete schedule for the ordering of materials, manufacturing, assembly and installation thereof was set up after a canvass of probable material deliveries and of the labor situation. It became evident that a period of twelve months would be the shortest time possible to complete the necessary work, keeping in mind that war demands might upset the schedule, and all effort was centered on finishing the project within the minimum time. Specifications and plans were completed for each individual project, numbering all together about 110, and each one was charted with due regard to the materials involved, quantity, desired time of delivery and installation and its relation to the project as a whole. As items of material were, of course, duplicated in a great many of the specifications, a master chart was prepared showing the total quantities of each of the thousands of items required at specified dates.

Call Transfer Equipment

The largest single project consisted in the design and manufacture of the 66 position special tandem switchboard and associated equipment to be located in Olive Office for the translation and distribution of calls from automatic stations to manual stations in the downtown area. This switchboard, together with the switching circuits, were designed in detail by the engineers in the general office of the

telephone company, and all of the manufacturing and assembly work was performed in the Western Electric Company shops at San Francisco. Extensive rearrangements of the Olive Office building were necessary to provide space for this equipment and for retiring quarters for the large number of operators required to give the necessary 24-hour continuous service.

In the manual offices it was found to be desirable to equip the regular subscriber positions with a dial for sending out the electrical impulses, and providing outgoing trunks connecting directly with the automatic equipment in the adjacent office. The manual keyboards were badly congested with ringing and listening keys, cords, clearing signal and order wire keys. There were approximately 375 subscriber switchboard positions in the manual system in the Los Angeles exchange that required the installation of this special equipment and associated wiring and this proved to be one of the most difficult parts of the work, because such work had to be performed on positions of switchboard that were in continuous operating service.

Expediting the Work

Central office telephone installation work has generally been organized for individual projects usually confined to a particular office building. The plan of scheduling the material and utilizing this material to its greatest advantage made it necessary to depart from the regular practices of the installing forces and to provide that all of the work should be treated as one project wherein the men trained for specific work were to be moved from one office to another as materials arrived and thereby facilitating the completion of the work regardless of irregularities in the arrival of materials for a particular office.

This arrangement was one of the important factors in effecting the final completion of the central office work as at April 30, 1918. The time intervening from this date until the beginning of the delivery of the directory and the formal announcement of consolidation on June 1, 1918, was required in placing thousands of test calls over all combinations of connections to make sure of positive operation. In a typical connection between an automatic and manual station there are 41 relays and 79 from manual to automatic, having movable parts controlling from one to ten electrical contacts, each of which must function in proper sequence from the start to the completion of each telephone call. I do not wish to convey an impression that telephone circuits are inherently subject to failure because they are not. The characteristics and operating requirements for each relay, for instance, are known mathematically and what it can be depended upon to do for a specific period of time. At regular intervals each type of relay is given its proper current adjustment, using measuring instruments designed for that purpose.

The installation of telephone cables and central office equipment of the manual or automatic type required the use of highly trained and skilled labor and the Telephone Company faced the difficulty of obtaining the large number of electricians and mechanics required to hold the schedule and training them for the special work. As it was, considerable overtime became necessary to maintain a working balance between the arrivals of material and the available labor.

Among the larger items of expenditure, and one involving months of study and calculations in voice transmission, were the additions and changes necessary in the cable trunking plant in order to maintain commercial standards on all local and long distance connections. These studies included the use of and application of loading coils to the former Home Company cable plant amounting to about one thousand coils, and the addition and respacing of many of the coils in the portion of the Pacific Company cable plant. All together about 75,000,000 conductor feet of various gauges of underground telephone cables were ordered and installed to provide new routes and reinforce existing trunk groups required for the consolidated service.

Eliminating Switchboards

Prior to the consolidation practically all of the subscribers having private branch exchanges maintained duplicate switchboards and station apparatus. The problem, therefore, of consolidating this type of equipment offered no particular difficulty, as such consolidations could be and were effected by grouping the trunks formerly serving the separate systems on the particular switchboard to be retained, adding thereto the amount of line and trunk facilities desired by the subscriber and eliminating the duplicate switchboard and stations not required. The net effect was to remove about 345 single position private exchange switchboards from the system. In the case of several of the largest commercial companies, it was necessary to order complete multiple private branch exchange switchboards of the 640-line capacity and all together about 30 sections of such boards were placed in service as fast as the equipment could be engineered and manufactured. It will be interesting to note that the flow of traffic to and from private exchanges was not greatly disturbed from the existing paths by this plan of consolidating; a principle which was kept well in mind and taken advantage of wherever practicable.

Where individual and party stations were duplicated, both stations were left connected until the new directories were delivered, at which time the subscriber was requested to use the telephone of the particular system that he had made application for and the other station was removed as soon as the construction forces could handle the work. Approximately 12,000 duplicate stations have been removed.

Difficulties in Obtaining Operators

A considerable number of operators were required and for a while it looked very much like the consolidation would have to be postponed because of the inability to obtain the needed force. Good service depends to a large extent on capable and efficient operators and you can appreciate the difficulty that confronted the operating department in the selection, employ and training of approximately 500 additional operators required for handling the special transfer switchboard installed in the Olive Office

building, and for the large number of added positions of switchboard in the various manual offices. A large operating school equipment was hurriedly manufactured and installed and training of operators was started about the first of the year 1918. The schedules also provided for the early installation of dials on the subscriber positions in the manual offices for advance training of the regular operating force. Special observation equipment was designed and furnished for practice work in placing test calls and later for supervision in determining and checking the accuracy of dialing the calls placed by the subscribers. By means of automatic recording devices the numbers called for by subscribers or instructors were compared with the numbers actually dialed and in this way the operating force was gradually brought to an efficient basis by the time the construction work was completed.

Readjusting Subscribers

Proceeding under the restrictions that each subscriber having duplicate service should determine for himself whether he retain automatic or manual substation equipment, the Commercial Department carried on a vigorous campaign to obtain each subscriber's wish and to arrange accordingly. The expected result of this canvass had been forecasted and was an essential factor in engineering and construction work.

As a function of the commercial canvass the directory department was confronted with the necessity of recasting the entire directory scheme to fit the particular needs of a unified service. A great amount of thought was given to the determination of the most efficient arrangement of listing and numbering subscribers, and while this seems trivial yet a careless directory arrangement reflects on the quality of the telephone service and robs the public of valuable time. Many number changes were involved and a complete relisting of every subscriber's name and number into one alphabetical list introduced great possibilities of errors. (It is a matter of passing interest that 165,000 copies of the directory were issued and distributed in Los Angeles and to other exchanges for long and short haul toll traffic and that over 441,000 pounds of paper were required in the printing of the consolidation issue.)

Actual Operation

In the present unified plant, local calls are generally divided into four groups and are obtained in the following ways.

Calls from automatic subscribers to automatic subscribers are obtained direct by dialing the number wanted, and as indicated in the directory listings. Calls from automatic subscribers to manual stations are obtained by operating the digit numbered "9" on the dial. This operation carries the connection through to an "A" operator in the adjacent branch office or to the special transfer board in the Olive office of the downtown district where a lamp lights to indicate that a subscriber is calling. An operator requests the number desired and then passes the call by the use of a manual order wire to a completing trunk operator in the district or particular switchboard unit of the called-for party.

Calls from manual subscribers to manual subscribers are obtained by the removal of the receiver from the switch hook thereby lighting a lamp before an "A" operator, who obtains the number called for and completes the connection by the aid of an order wire in conjunction with the trunk operator serving the called-for station. Calls from manual stations to automatic stations are obtained by the removal of the receiver, which lights a line lamp before an "A" operator, who, upon receiving the number called for notes that it is an automatic station number and proceeds to operate the dial accordingly, thereby completing the connection direct with the called-for party.

	Automatic to Manual	Manual to Automatic	Total Calls
May 31, 1918 (1 day before formal announcement)	16,308	31,870	48,178
June 31, 1918	71,883	70,921	142,804
July 19, 1918	83,589	76,556	160,145
August 23, 1918	95,059	80,285	175,344
September 13, 1918	105,602	88,161	193,763

The rapid building up of this service is evident and it is expected that the volume will increase considerably and approximate the amount of traffic for which the present consolidated plant is constructed.

Benefits and Disadvantages

As far as I know no definite statement can be made as to the gains accruing to the subscribers at Los Angeles under the consolidated arrangement, because the most important factors are not capable of reduction to equated savings in dollars.

Some of the major factors resulting in direct benefit are:

1. Value to the subscribers resulting from telephone access to each and every subscriber in the Los Angeles exchange and to all long distance lines centering there.
2. Rental savings resulting from the elimination of a large number of duplicate stations and private exchange switchboards.
3. Elimination of the indirect economic loss due to confusion and community service inefficiency of separate telephone systems.

Some of the factors which tend to offset part of the savings are:

1. Added annual charges on the plant and equipment required to provide means for universal service. There was very little elimination of duplicate plant investment primarily because each plant was designed to care for a definite development and volume of traffic, but because the telephone field is considerably increased to every subscriber, the total volume of traffic in the consolidated plant is substantially increased.

From a careful weighing of these factors it is patent that the consolidated plant offers substantial savings and benefits over the dual systems. The worth of a telephone system to any community lies, not only in its ability to give good service, but that such service shall be universal and available to the maximum possible number of subscribers.

THE HETCH HETCHY RAILROAD

BY RUDOLPH W. VAN NORDEN

(Several of the western power developments on a large scale have necessitated the building of company railroads. Undoubtedly the most extensive of these is the railroad to the Hetch Hetchy water and power project undertaken by San Francisco. Special interest attaches to this particular system owing to the possibility of its later electrification and adaptation to the later requirements of the project. The author was formerly connected with the San Francisco city engineer's office and has recently been over the work.—The Editor.)

Typical country over which the railroad passes. The total length of the road is 68 miles.

IN order to proceed seriously with construction work of the magnitude contemplated on the Hetch Hetchy water and power project of San Francisco, means of rapid and comparatively low cost transportation from existing railroads throughout the entire length of the project was the first and most apparent necessity. The nearest railroad to any point east of the Tuolumne crossing was the line of the Sierra Railway. This railroad connects at Oakdale with the Southern Pacific and runs to Sonora, the county seat of Tuolumne county. It was built many years ago to tap the rich Mother Lode mining section which passes through Tuolumne county. The main line of the road meanders around the hills south of Jamestown, passing along the ridge on the north side of the Tuolumne, not far from the projected conduit crossing of that river. Here is a point, now called Hetch Hetchy Junction, which marks the terminus of the Hetch Hetchy railroad.

Course of Railroad

The Hetch Hetchy railroad, after leaving the junction, takes a course westward, descending the west bank of the Tuolumne to a point one mile west of the inflow of Moccasin creek. Here the crossing is made over a steel overhead truss having a clear span of 220 ft., the approaches being deck plate girders of 40 ft. span. It is designed for Cooper's standard specification E-35 loading.

After leaving the river, the grade ascends the east side of Moccasin creek, passing above the power house site, circling around to the south of the projected forebay reservoir and thence above the Priest Portal camp, thence continuing through Big Oak Flat to Groveland, where are located the headquarters, not only of the railroad, but of the entire work. A negative grade from Groveland carries the railroad past the Big Creek Shaft, thence resuming the upgrade, and the canyon of the Tuolumne is skirted into the South Fork, which is crossed on a ballasted deck timber trestle to the South Fork Camp at an elevation of 800 ft. above the South Fork portals. The climb is again resumed when the slope of the Tuolumne canyon is reached and the ridge between the main and Middle Forks is followed to Hog Ranch. Soon after passing this point, the summit, or highest point in the grade, is attained at Poopenant Pass, El. 5064, thence the descent is made, a distance of 7½ miles, to the Damsite Camp at the Hetch Hetchy valley. Here the line runs through the camp where there are several switch tracks, a freight yard and a cattle corral; passes the warehouse, thence around the knoll at the south end of the damsite, but on a grade 40 ft., above the proposed crest of the dam, thence circling back to the main line. The last section from the damsite returning to the main line has not been completed, otherwise the railroad construction is finished except for the stone ballast, the entire line being laid on the sub-grade.

THE ROAD IN USE

The equipment of the road consists of two Heisler and one Shay geared locomotives, using oil fuel, but if the road is to be used later for transportation of lumber and saw logs it will probably be equipped for electric operation.

Material and Equipment

The total length of the railroad is 68 miles. Throughout, except for a few short stretches, the grade is laid to 4 per cent, compensated. The maximum curvature is 30° and there are many curves from 20° to 28°. Standard ties of pine were supplied largely from the city's own mills, or those near the line. The rails are A. S. C. E. standard 60 lb. per yard. The equipment consists of two Heisler and one Shay geared locomotives, using oil fuel. These will be superseded as soon as war conditions will permit with direct-connected Mikado type locomotives. Local passenger traffic is by means of motor trucks fitted with flanged wheels with which a regular daily schedule is maintained. The road was built by contract, and much heavy grading was necessary,

especially in the upper end where, along steep side-slopes, the solid granite was benched in many places for long stretches. The last 9 miles from Hog Ranch is graded to a width of 22 ft. This is for the purpose of providing a highway into the Hetch Hetchy after all construction work shall have been completed. The main highway to Yosemite passes through the South Fork camp and there is a branch which goes to Hog Ranch and thence over to join the Tioga highway. It is proposed to continue this road from Hog Ranch into Hetch Hetchy with a wide concrete boulevard.

Of Local Use Only

The impression that has at times become current, that the Hetch Hetchy railroad would at some future time become a part of a transcontinental railway, or even a trans-Sierra railway, is erroneous. The heavy grades and curvature will not permit of any rapid traffic or use as such a railway would be

THE BRIDGE OVER THE TUOLUMNE

The grade throughout except for a few short stretches is laid to 4 per cent. The maximum curvature is 30°, there being many curves from 20° to 28°.

expected to perform. It can be equipped for electric operation and later used for local business, principally the transportation of lumber and saw logs, which promises a lucrative return. The construction cost of the Hetch Hetchy railroad was $29,400 per mile, or to be exact, a total amount paid the contractor of $2,000,000. More than 1,000,000 cu. yd. of excavation, mostly rock, was necessary and 500,000 B-M ft. of lumber was used in trestles.

THROUGH THE PACIFIC NORTHWEST BY ELECTRIC RAILWAY

BY D. H. COLCORD

An ideal way to see the country is through the open window of a strictly modern electric railway car. This is especially true in traveling in America's great wonderland of the West—the State of Washington. Undoubtedly there is no electric system in the world that covers as diversified ground as the Pacific Northwest Traction Company, which extends from Bellingham, Washington, to Mt. Vernon, a distance of twenty-eight miles. Bellingham is located on an immense arm of the sea, Puget Sound, which

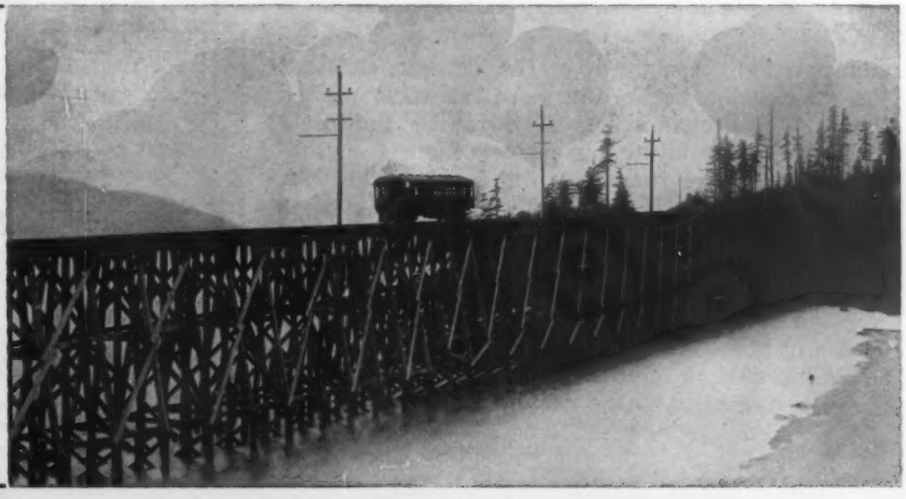
SKIRTING CHUCKANUT BAY

Typical of the mountain scenery through which the road passes

extends through the State of Washington for 250 miles. The present system is one of particular beauty, passing through a region rich in industry and agriculture and with great undeveloped water resources.

A substation is located at Clayton Bay, from which the car passes over several miles of trestles. The entire unusual trip through mountain scenery and over country formerly traversed only by trails is made under electric power, the cars being furnished with Westinghouse motors. The line is soon to be extended from Bellingham to Seattle.

The use of the electric car not merely as a means of getting between two points, but over scenic routes in the mountain districts as well, is an innovation to which the West is particularly adapted. The Pacific Northwest Traction Company's line between Bellingham and Mt. Vernon serves the very useful purpose of providing transportation between the two points, but it is besides a trip to be taken for its scenic interest alone.

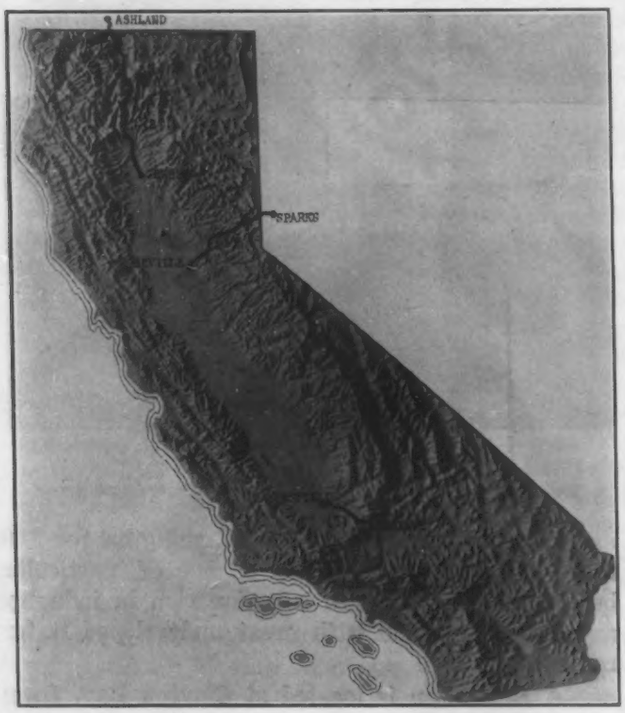


FUEL OIL SAVING IN RAILWAY ELECTRIFICATION

(The U. S. Fuel Administration during its regime in California recommended the electrification of certain of the mountain sections of the railways of this state with the object of conserving fuel oil. Although this was proposed as a war measure, the data is now at hand for peace time purposes and serves as an indication of the possibilities of electrification from a financial as well as a technical standpoint. Extracts from Mr. Dietrich's report were given in an early issue, but the accompanying charts are of special interest.—The Editor.)

The basis for the report and its present application may be judged from the following introductory statement:

Present conditions of traffic and for the most part present prices are considered. It must be remembered in this connection, however, that the annual traffic is constantly on the increase, and that the greater the traffic, the more favorable will be the case for electrification. Likewise, the unit costs of electrification under present conditions are probably much higher than they will be after the war, while at the same time it is hardly likely, in view of the impending shortage of fuel oil, that the cost of fuel oil will ever be less than it is at the present time.



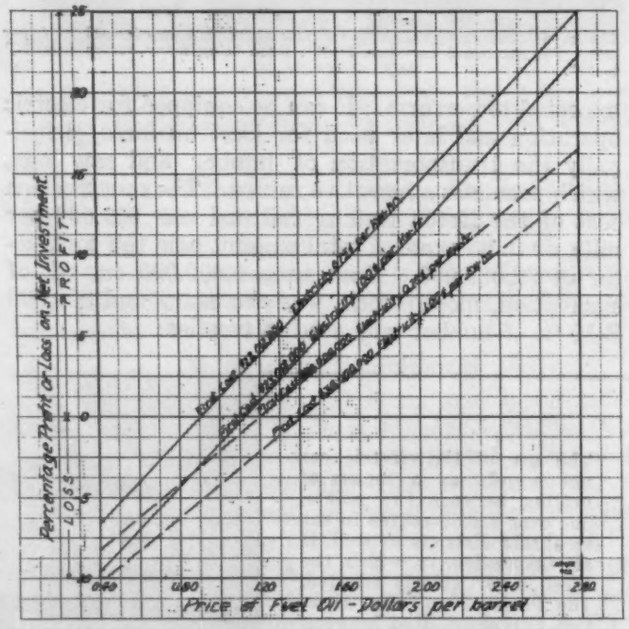
PROPOSED RAILWAY ELECTRIFICATION FOR CALIFORNIA

An expenditure of $23,000,000 on the proposed electrifications will result in an annual saving of over 3,000,000 barrels of oil and will return a net profit of 9 per cent on the investment, at the present prices of fuel oil. The annual electric power requirements will be in the neighborhood of 267,000,000 kw-hr. and the maximum demand will be 121,600 kilowatts. The districts considered for electrification are (1) Part of the Sacramento Division of the Southern Pacific Company, from Roseville, California, to Sparks, Nevada, (2) Main line of the Shasta Division of the Southern Pacific Company, from Gerber, California, to Ashland, Oregon, and (3) Part of the San Joaquin Division of the Southern Pacific Company, from Bakersfield to Saugus, California. The Atchison, Topeka and Santa Fe Railway uses the Southern Pacific Company tracks from Bakersfield to Mojave.

The railroads consume more coal and fuel oil than any other single industry. Over 20% of the annual production of coal and fuel oil in the United States is consumed by the railroads, and half of this amount is wasted by the inherent inefficiencies of steam locomotion. Of the California production of fuel oil in 1917, 31.2% was consumed by the western railroads. The West is facing the necessity of providing for rapidly increasing fuel demands with a declining production of oil from California fields. Some of this demand will be met by increased hydroelectric development, some will be met by the utilization of low grade bituminous fuels and the opening up of new coal fields, but this does not lessen the importance of conserving fuel in every way possible, and one of the first steps in this conservation is to eliminate as much as is commercially feasible the wasteful use of fuel by the railroads.

Thus it can be seen that railway electrification will become more and more a necessity, both from the standpoint of saving in operating costs, and from the standpoint of the conservation of fuel oil.

According to the results obtained in this report a net expenditure of $23,000,000 on the proposed electrifications will result in an annual saving of over 3,000,000 barrels of oil, and will return a net profit of 9% on the investment, at the present prices for fuel oil. The annual electric power requirements will be in the neighborhood of 267,000,000 kw-hr. and the maximum demand will be 121,600 kilowatts.



PROFITS POSSIBLE FROM RAILWAY ELECTRIFICATION

The effect of fuel oil prices, the cost of electricity and the increase in first cost on the percentage of profit obtainable by the proposed electrifications in California is here graphically illustrated. Thus it will be seen from the chart that with oil at $1.60 a barrel, with an initial cost of $30,000,000 and electricity at 1c per kw-hr. approximately 2 per cent profit on the investment would be obtained. With less initial cost, as much as 9 per cent is possible. With oil as low as $0.90, no profit would be obtained and the project would be out of the question.

Co-operative Campaign Problems

BY W. F. BRAINERD

(The representatives of the California Electrical Cooperative Campaign in their traveling about the country have an opportunity to note clever methods of merchandising as practiced by the electrical contractor-dealers of their district. Brief descriptions of such items will appear from time to time in the columns of the Journal of Electricity. The following is from the representative of the campaign in the northern district.—The Editor.)

FOLLOWING UP THE WIRING JOBS

A bundle of assorted folders of the various electrical household helps is sent out to every house-wiring job by the Garden City Electric Company of San Jose.

These folders are included in the requisitions for material for each job and are treated as part of the necessary material for the job. Tied in a bundle they are fastened to a fixture, so that they will be found by the incoming tenant in new houses. In houses already occupied they are placed in the hands of the lady of the house.

Manager Henry Doerr says he can trace many sales to this method of advertising.

SECURING A STORE MANAGER

Securing competent store managers has been one of the problems the electrical dealer has had to meet.

It has been found that most of the experienced competent men have had their training along a practical line, rather than as merchants. While men can be found who can sell a big wiring job, it is hard to find a man who can handle the store in a way to sell Mrs. Jones her electric iron.

One live dealer in Oakland has worked this out to his own satisfaction. The former manager of a department in a stationery store was secured. His merchandising experience has resulted in an attractive arrangement of the interior of the store and properly dressed windows, frequently changed. He has also been able to institute many good selling plans. The advertising is also handled by him; as there are a number of experienced electrical men in the store organization, he can always get help on electrical jobs.

The owner of the store is greatly pleased with this arrangement, as he says that it results in a better looking store, more attractive windows and greater sales.

STANDARDIZING ADVERTISING

A very effective way of impressing his business on the mind of the public and then tying it to his store has been originated by H. G. Chaffee of Chaffee's Electric Shop, Visalia.

In prominent locations on all of the main highways leading into Visalia Mr. Chaffee has erected large signboards, cut out in the shape of an electric lamp. On the board in addition to the name and address, is the statement that he handles "wiring fixtures, etc."

The unusual shape of the board, besides attracting attention, impresses the fact that it is electrical goods being advertised. To tie his store more closely to the advertising, one of the signboards is mounted on the front of the store.

Mr. Chaffee says he can definitely trace an increase in his business to this unique form of advertising.

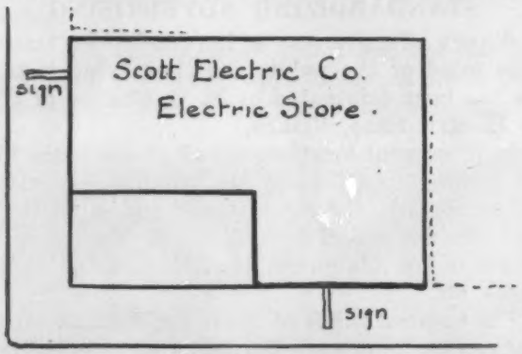
ASSISTING UNIVERSITY EXTENSION

A splendid new field of usefulness has developed in the educational work of the Campaign. The Extension Division of the University of California is revising its course for electrical workers so as to meet the needs of technical study in all branches of the industry throughout California, and a special committee consisting of R. M. Alvord of the Advisory Committee and Robert Sibley, editor of the Journal of Electricity, has been appointed to cooperate in every way possible in forwarding this helpful work.

A striking sign which has the same advantage as a trade mark. It is always the same — and is to be seen on road corners and along the main highways over the countryside. The same sign is used over the door of the Electric Shop and means that the end of the pilgrimage is found—and that this is the store whose advertising was seen several miles out of town.

Western Ideas

THE CORNER STORE has its advantages, of course, but the "ell" store which encircles the corner with an entrance on two streets may prove equally effective in location. This is certainly true of the Scott Electric Company of Portland, Ore., of which a view is here shown. The business has the advantage of the traffic on both streets during the day time with perhaps even greater appeal than has the corner. Windows are always well arranged and of a nature to be remembered, so that the passer-by is conscious of passing the same store twice in rounding the corner. This leaves time to recall that lamps are needed or that the electric iron needs repairing, and by the time the second door is reached, the prospect who has made up his mind to remember the errand the next store he passes is ready to become a customer.



The store is built on an ell, thus providing an entrance and store front on both streets

The signs are flashed on alternately at night, which produces a most striking effect when viewed from the opposite corner

At night an effective electric sign doubles the drawing power of the shop. Duplicate signs are erected over each entrance and are flashed on alternately, one sign dying out as the other goes on. From the street the effect is most striking.

THE DEMONSTRATION CAR has long been a recognized factor in University extension work. The same medium for "spreading the gospel" has been adopted by a California central station which sent a trolley car through the rural districts fully equipped with the latest electrical labor saving devices for the home, giving demonstrations at villages along the road. A large volume of sales was traced directly to this source.

Another productive sales effort was the demonstration of electrical appliances before rural schools. The demonstrator made appointments to lecture to the pupils with the understanding that he would not mention buying or selling.

Not the least important result of this educational work was the good will it built up for the company.

THE PROOF OF THE PUDDING is in the eating—and the best advertisement of an electric range is the successful demonstration of its use. The luncheon, the account of which is here given, was not merely a delightful occasion therefore but served as very good advertising.

Forty-five members of the sales and executive staff of the Northwestern Electric Equipment Company, of St. Paul, sat down to an electrically cooked luncheon at the St. Paul Hotel recently and partook of a meal which was prepared on a Model "D" Hotpoint range, manufactured by the Edison Electric Appliance Company. This affair took place during the annual conference of the Northwestern Electric Equipment Company. It was unique in that the entire meal was prepared at a total cost for current of 31.128 cents, or .00691 cents per person, which is a trifle less than seven mills.

Some interesting figures were brought out as the result of this luncheon which we believe are interesting enough to tell the reader. The total wattage was 7782, or 172.9 watts per person, the extremely low consumption being accounted for by the successful utilization of stored oven heat. The current consumption of the three surface burners was 2682 watts. Here are some interesting figures on the wattage consumption of the various items which comprised the menu:

10 cans soup	469	watts
18 lbs. roast beef	2325	"
1½ pecks potatoes, 2 cans peas	1188	"
5 cans corn	300	"
6 loaves bread	1000	"
5 dozen rolls	700	"
50 portions pudding	1275	"
70 cups coffee	525	"

The luncheon was prepared under the auspices of Mr. A. H. Jaeger, the Northwestern Sales Representative of the Edison Electric Appliance Company, Hotpoint Division, and was assisted by Miss Bernice Bell, Domestic Science Expert of the Northern States Power Company, who was responsible for the preparation of the viands. The luncheon was unique in more ways than one in that the menu was prepared in terms the average restaurant patron would scarcely understand, the items being as follows:

Switches — Insulators
Transformer Oil — Braces
"Heart of the Range" with HP (Hotpoint) Sauce
Chafing Dish Service
Bushings
Standard Oven — Ovenettes
Insulation
Day Load — High Voltage
Percolation — Binders and Fittings
Hotpoint Ideals

A SAVING OF TIME as well as string is suggested by an ingenious method of tying a bag recently illustrated in the Popular Science Monthly. The old method required enough string to encircle the parcel two or three times before it was held securely and that needed from 20 to 36 inches of string for a moderately small package.

Method of fastening package

The new method is as follows: Close the bag according to the old method. In the first fold place the string and fold as often as is necessary after that to adequately close the bag. The corners are then turned toward the center and flattened. This brings the two ends of the string together to be tied. The finished package is neat and firmly tied, presenting a pleasing appearance, and what is unusual, only four or five inches of the string is required to make the tie.

THE DANGER OF MARKING DOWN goods is that you discredit the legitimate price you originally asked for them. A woman was heard, not long ago, to read an advertisement of $5 hats for $2.98, and to express wonder that a store could sell them at such a low figure and still make a profit, for she did not believe the store proposed to lose money.

"Think what a profit I would have paid them at $5.00," she said.

That is one side of the story, says a bulletin from the National Vigilance Committee of the Associated Advertising Clubs of the World.

The other side is that a great many other women refuse to believe that the article advertised was ever worth the higher figure named—or $5, as in this case.

"Usual value," or "value" or "worth" are destructive advertising expressions, the bulletin from the committee declares. They dull the appeal of advertising. When a store does have a real sale to move off odds and ends, a great many readers of its advertisement are in the same attitude as the men who declined to come when the little boy in the old story called "Wolf, wolf."

It is being proved, the committee says, that business of a more permanent character can be built without such statements. If there has been a special purchase, a store can get a crowd by announcing that a fortunate find has been made by its buyers. It is needless to "compare prices." Business men, says the bulletin from the committee, are learning that truth-in-advertising has an economic value, and that in the long run, it pays to understate rather than over-state in an advertisement. The under-stated advertisement may bring fewer people, at times, but it will sell more goods, for when the customer is surprised to see such goods at such a price, sales are more readily made. There is less of a tendency to "shop around."

"No advertiser can afford to take the stand that his advertising policy is correct merely because his advertisements sell goods," says Merle Sidener, chairman of the National Vigilance Committee of the advertising clubs. "There is more than this to success. Advertisements and store policies must work together in the making of customers, not the mere sale of goods. Many a store which has had wonderful 'special sales' has in the end been forced to change its policy or go out of business, when these sales have been based upon deception."

The bulletin points to two stores—one a clothing store in Indiana, the other a millinery store in Ohio—which can draw enormous crowds to special sales, using small advertising space, simply because the owners have not advertised bargains day after day, but have advertised bargains only when they actually had stock reduction sales.

In another instance, it is the custom of a department store, when selling "seconds," to mention the fact that the goods are especially priced because of small imperfections, and it suggests to customers that they ask the salespeople to point out the defects in each article. A similar policy has been followed by a clothing store in one city, with equal success.

It pays to be truthful—it brings better profits, declares the vigilance committee, and this opinion is based upon the actual experience of many leading stores.

NEW IDEAS are apt to get lost if not jotted down. Of course the majority of business men use some form of "tickler," the most common being the small box for 3 inch by 5 inch cards with 1 to 31 and January to December guide cards. In addition a few guide cards act as special reminders, the most important being the one marked "New Ideas." One business man wrote of his system:

"I believe most of us frequently have 'pop into our heads' ideas that are really very valuable, but which we can not use just at the moment. Often these ideas are lost before they can be used. I make it a rule to jot down any new idea on a 3 inch by 5 inch card (I generally have a small supply in my pocket) whenever the idea comes into my head. Many of my ideas come to me while on the train or street car, as at that time my mind seems to be unusually active. When I get into the office I drop these cards in front of the 'New Ideas' guide cards, except those bearing suggestions I want to put into action at some definite date in the near future, which I drop in the tickler, so that they will come up on that date.

"On the 10th, 20th and 30th of each month a card comes up in the tickler marked 'Review New Ideas.' At this time I take out all the 'New Idea' cards and look them over. If I think I will want to put any of the suggestions into action in the near future, I drop the card into the tickler, so that it will come up at the proper time. The other cards I drop back to be reviewed again later, or throw them away, as the case warrants."

OREGON CONTRACTOR'S LICENSE LAW

(The use of electricity is becoming so common in country districts where there is often no provision for the inspection of installations, that it becomes necessary to standardize practice in electrical contracting. Laws are being proposed in the legislatures of several of the western states aiming at this end through licensing of those permitted to make installations. Here is the text of the proposed Oregon law.—The Editor.)

Section 1. From and after the taking effect of this act all installations in the State of Oregon of wires or equipment to convey electric current, or installation of electric apparatus to be operated by such current, shall be made in accordance with the laws of the State of Oregon, or city ordinances or building codes relating to such work of the city or town in which such work may be done and in the absence of state law, and in the cities and towns of ordinances or building codes, prescribing the manner of installation of wires and electrical equipment to convey electric current and of electric apparatus to be operated by such current, such work shall be done in substantial accord with the rules laid down for such work by the United States Bureau of Standards relating to such work so far as the same covers both fire and personal accident hazards and as the same shall be compiled and published as hereinafter provided.

Section 2. All persons, firms or corporations hereafter engaging in conducting or carrying on the business of installing wires or equipment in the State of Oregon to convey electric current or installing apparatus to be operated by such current, shall on or before the 1st day of July of each year file with the Secretary of State an application in writing for and obtain a license so to do; which application shall state the name and address of the applicant, and in case of firms the names of the individuals composing the firm, and in case of corporations the names of the managing officials thereof, and shall state the location of the place of business of the applicants and the name under which the business is to be conducted. No license hereunder shall be issued until the applicant therefor has paid to the Secretary of State for the benefit of the State of Oregon an annual license fee of Fifteen Dollars ($15.00) and shall have executed a bond in the penal sum of Five Hundred Dollars ($500.00) running to the State of Oregon with good and sufficient surety to be approved by and which bond shall be filed with the Secretary of State, to be conditioned that in the installation of wires or equipment in the State of Oregon to convey electrical current or apparatus to be operated by such current, the principal in such bond will make such installations according to the requirements of the laws of the State of Oregon, or city ordinances and building codes of the cities or towns in which such electrical installations are made relating to and in effect at the time of entering into the contract for such work, and that in the absence of state law, city ordinance or building code covering such work, the principal will make such installation substantially in accord with the rules laid down by the United States Bureau of Standards, to be furnished as hereinafter provided, relating to such work so far as the same covers both fire and personal hazards, and conditioned further that the principal will pay all labor and material claims upon such work and all damages sustained by any person, firm or corporation arising from failure of the principal to make such installations in the manner aforesaid.

Section 3. Any person, firm or corporation making application therefor and affidavit to the Secretary of State that such person, firm or corporation has been damaged by the failure of the principal in any such bond to comply with the requirements of this act or the provisions of the bond given, shall be furnished with a certified copy of the bond of the person, firm or corporation named in such affidavit, and shall have the right to bring an action in the name of the State of Oregon for his or their use and benefit against such principal and surety to recover for any labor or material furnished the principal in such bond and unpaid, and for his or their damages arising out of the failure of the principal named in such bond to comply with the requirements of this act, and to prosecute the same to final judgment and execution; provided, that the surety's total liability on such bond shall not exceed the sum of Five Hundred Dollars ($500.00) and the right to commence action against such surety shall not exist for a longer period than Ninety (90) days from the substantial completion of any contract.

Section 4. All licenses shall bear the date of issue and shall expire on the 1st day of July next following the date of issue, provided that all licenses issued prior to the first day of July, 1919, shall expire on the 1st day of July, 1920.

Section 5. Every person, firm or corporation licensed under the provisions of this act shall be entitled upon the expiration of his license, or the renewal thereof, by the payment of a fee of Fifteen Dollars ($15.00) on or before the date of his expiration of license or any renewal thereof to have his license renewed for the ensuing year ending July 1st, so long as the bond originally given in compliance with the provisions of this act shall remain in force. The cancellation of or revocation of or the withdrawal of the surety from any bond filed in accordance with the provisions of this act shall ipso facto work a suspension of the license of the principal on such bond, until such time as such principal shall furnish a new bond to be approved by the Secretary of State.

Section 6. It shall be the duty of the Secretary of State to obtain and keep on file in his office a copy of the rules of the United States Bureau of Standards relating to the installation of wires and equipment to convey electric current, and of electrical apparatus to be operated by such current so far as the same covers both fire and personal accident hazards as promulgated and issued by such bureau on the first day of July of each year, and to have printed and delivered to all persons licensed under the provisions of this act, and upon request to the general public, copies of such rules on file in the office of the Secretary of State on the first day of July of each year shall be deemed the rules laid down by said Bureau of Standards for the following fiscal year, and printed copies of such rules, certified to as such by the Secretary of State, upon the date named in such certified copy.

Section 7. The licensing provisions of this act shall not apply to individuals, firms or corporations or to municipalities authorized to engage in the business of making or selling electricity in connection with the construction or maintenance of lines or wires for the transmission of electricity from the source of supply to the service switch, fuses or circuit breakers on premises or property to be supplied, nor to the work of individuals, firms, corporations or municipalities in installing, maintaining or repairing on the premises of customers' service connections and meters and other apparatus or appliances used in the measurement or the consumption of electricity by customers, nor to work in connection with the lighting of strets, alleys, ways or public areas or squares, nor to the work of persons, firms or corporations in installing and maintaining wires, apparatus and appliances used in their business on their own premises, nor to individuals, firms or corporations installing, maintaining or repairing apparatus or wires for making or distributing electricity upon the premises or property owned by them nor to persons en-

gaged in the business of installing or repairing ignition or lighting systems for motor vehicles.

Section 8. The Commissioner of Labor and Inspector of Factories and Workshops of the State of Oregon is hereby required so far as possible to see that the provisions of this act are enforced, and the amount remaining of the license fees collected hereunder, after deducting the expenses of the Secretary of State arising out of this act, shall be used so far as may be necessary to pay the expenses incurred by him in the enforcement of this act.

Section 9. No person or persons carrying on, conducting or transacting business as aforesaid shall hereafter be entitled to maintain any suit or action in any of the courts of this State, without alleging and proving that such person or persons have been duly licensed at the time of performing such work as provided in Section 2 hereof.

Section 10. Any person or persons violating the provisions of this act shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not to exceed One Hundred Dollars ($100.00).

SPACE RATES FOR ELECTRIC SERVICE

The city light department of Tacoma, Wash., has established a rather novel schedule of electrical rates for residences which has been in effect since 1916. In order that customers may fully understand the schedule, a series of cards and pamphlets has been issued which clearly explain the basis of calculation and the method of procedure.

The rates for residence lighting are briefly set forth as follows:—

For the benefit of those customers who are not familiar with the technical terms used in the ordinance covering rates for electric current used in dwellings, the following explanation is given:

Minimum monthly charge is 50c.

Rate for current used for lighting is reduced from 5½c per kilowatt hour to 5c per kw-hr.

For the benefit of those wishing to use electricity in the home for other purposes, a rate of 1c per kw-hr. is made for all current used in excess of the maximum quantity to be paid for at 5c per kw-hr., said maximum quantity for each home being determined by the square feet of floor space as follows:

Parlors, living-rooms, libraries, dining-rooms, kitchens and pantries are considered as "Working Space" and the total square feet in this working space is taken.

Halls, bath rooms and bed rooms are classified as "Idle Space" and only one-half of the total square feet is taken.

Basements, attics, clothes closets, porches and out-buildings, unless used for purposes bringing them into one of the above classes, are exempt and should not be considered.

This department has furnished, or will furnish upon application, a card upon which you may record the dimensions of the various rooms and such a record must be filed at our office before the benefit of the 1c rate can be obtained.

As an aid to consumers in determining what their bills will be, we give the following example of the cost of current for a five-room bungalow containing rooms of average dimensions:

Working Space

Rooms—	Dimensions	Sq. Ft.
Parlors	12 x 14	168
Dining room	12 x 14	168
Kitchen	10 x 12	120
Pantry	5 x 6	30
Total		486

Idle Space

Rooms—	Dimensions	Sq. Ft.
Hall	6 x 6	36
Bed room	12 x 12	144
Bed room	10 x 12	120
Bath room	6 x 10	60
		360
Take all working space		486 sq. ft.
Take one-half idle space (360 sq. ft.)		180 sq. ft.
Total equivalent floor space		666 sq. ft.

Multiplying 666 (the total sq. ft. of equivalent floor space) by 40 gives 26640 watt-hours, which, divided by 1000, equals 26.6 kilowatt hours or a value of 27 kilowatt hours under the ordinance. At 5c per kw-hr. 27 kw-hrs. amounts to $1.35, which is the sum the party owning the above house must pay at the rate of 5c per kw-hr. before being entitled to the rate of 1c per kw-hr.

Facts to Remember

Efficient electrical apparatus operating with electricity at 2c per kilowatt hour is cheaper than gas at $1.00 per thousand cu. ft. Therefore, the rate of 1c per kw-hr. made our customers after an average amount of current has been used for lighting, deserves your earnest consideration.

This 1c current can be used to do your cooking, heat your home or, with the aid of electrical appliances such as vacuum cleaners, washing machines, flat irons, toaster stoves, chafing dishes and numerous other devices, almost every form of household work can be made a pleasure at a minimum expense.

Note—No electrical appliance having a capacity of more than 660 watts shall be installed without a permit from the Electrical Inspection Department.

Form 50A—5-17—5M. Req. 14438

Notice to Applicants for Electric Service

Wiring in all buildings must be inspected before service will be connected

RECONNECTION

On buildings where electric service has been cut out and application has been made for service again, inspection will be made as follows (unless otherwise arranged at counter):

Application signed in morning—inspection afternoon.
Application signed in afternoon—inspection next morning.
Please have buildings open for inspection per above.

If repairs are necessary, written notice will be left on premises. Wireman making such repairs must take permit and notify Inspection Department (M. 571) when finished.

NEW SERVICES

To insure prompt service, applicant should call at Inspection Department, No. 402 City Hall, and ascertain if building has passed inspection on both Rough-in and Finish work.

LIGHT DEPARTMENT.

ADDRESS _____ St. _____ Flat _____

NAME _____ Date _____

WORKING SPACE			IDLE SPACE		
ROOMS	DIMENSIONS	SQ. FT.	ROOMS	DIMENSIONS	SQ. FT.
Parlor			Halls		
Living Room					
Library			Bath Rooms		
Dining Room					
Kitchen			Bed Rooms		
Pantry					
Total Sq. Ft.				Total Sq. Ft.	
½ Sq. Ft. Idle part					
Total Sq. Ft. Equivalent Floor Space					

PLEASE FILL OUT AND RETURN SEE OTHER SIDE FOR INSTRUCTIONS.

Two of the cards in use by the Tacoma City Light Department showing good contractor practice

Commercial lighting rates are based on a different schedule, which is accompanied by the following note:

Notes on Schedule

The maximum demand shall include the total connected wattage of lamps; empty sockets to be taken as 25 watts each. Heating devices not to be taken as part of the maximum demand except where maximum demand is measured by demand meters (at the option of the Light Department), in which case the maximum demand, as measured by the meters, will be taken. The demand used for computing the rate shall be figured to the nearest 100 watts only; any demand less than 200 watts shall be considered as having a capacity of 200 watts. Provided, that the minimum charge for current under this schedule shall be $1.00 per month.

GROUND TELEGRAPHY IN THE WORLD WAR

BY LIEUT. WILLIS L. WINTER

(Many of the developments of the war will find peace time application and add improvements in methods and apparatus which would have been long in coming to flower without the urgent necessity of the great conflict. The young men who served along specialized lines in France are now coming home to spread the knowledge they have acquired and fit it into home needs. One of these developments which may prove of considerable value is here described by a former lieutenant in the Signal Corps who saw active service in France and is now with the Westinghouse Electric & Manufacturing Company.—The Editor.)

When war is mentioned, the mental picture which naturally appears contains ruin and destruction. Seldom does one think of the workshops back of the "long thin line" where scientists are crowding the inventions and developments of decades of peace into the few short years of war. Some of these are sensational as, for instance, the aeroplane, the submarine or the wireless telephone between aeroplanes. Others, less important and less known generally, should be considered for application to the pursuits of peace.

Difficulties of Early Methods of Communication

When war broke out in Europe the transmission of intelligence was accomplished by one of the following means: telephone, telegraph, runner, visual

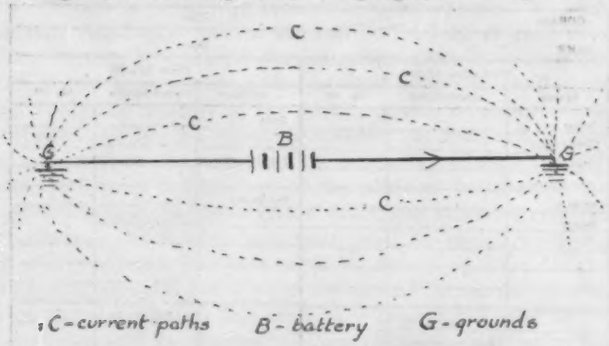
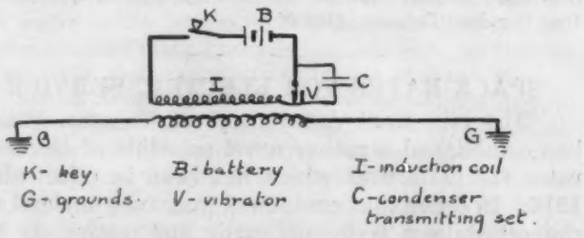


Diagram illustrating current lines through the earth

signals or wireless telegraph. Difficulties were immediately encountered, chief of which were these: (1) Telephone lines were constantly being cut by artillery fire just at the time when the communication was most needed, (2) the enemy was "picking up" our messages by induction and amplification and hence knew exactly what was happening within our lines, (3) the wireless antennae were too easily seen and the station too easily destroyed as a result, (4) the operation of the wireless set was too skilled—when the regular operator was put out of action there was no one to take his place, (5) too much time was consumed in getting messages back to headquarters (the need for quick delivery of a barrage call, for example, is apparent).

Developments of the War

Remedies for these troubles were sought and quickly found. Fireworks were introduced. Thus when a certain rocket was fired in the trenches it meant to the artillery observer that a barrage was wanted instantly in a certain sector. This system was developed to the point where the shells were screaming overhead within thirty seconds after the rocket was fired. A non-inductive telegraph was developed by the British called the Fullerphone, whose click could not be picked up ten feet from the instrument. It was copied and improved in our own Buzzerphone. But these did not fill the greatest need. Some means of communication was required which did not depend on metallic connection between stations and which had to be hardy enough to withstand shock and abuse. The wireless telegraph was



Diagramatic explanation of the layout in the transmitting of messages over the ground telegraph

good three or four miles back of the line but it was too frail and too easily put out of adjustment farther forward. As a result of this necessity the ground telegraph was developed.

Principles of Ground Telegraphy

Everyone is familiar with the phenomenon of the ground return circuit where only one side of the circuit is metallic, the other side being the ground. The electricity in returning through the earth distributes itself inversely as the resistance of the path that it takes. Just as though the earth between the two grounds were divided into small conductors and a portion of the current flowed in each one. Of course the direct line between the two grounds would have the lowest resistance and therefore would have the greatest current flow. As the paths become longer and longer the current flowing in them becomes less and less until finally it becomes exceedingly small.

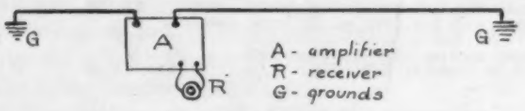
Now, if we install another grounded circuit, with a telephone receiver in it, in the affected area, part of the current flowing in the earth will be shunted through the circuit and any change of current in the primary circuit will make itself apparent in the receiver in the secondary circuit. When an alternating current is caused to flow in the primary or sending circuit the effect of the current flowing in the secondary circuit may be heard in the receiver for the length of time that the current is on. If the current is on for a short time we have a dot; if for a long time, a dash, the basis of the telegraphic means of communication.

In French practice (the American adaptation had not yet come into general use when the armistice was signed) the sending set is a heavy vibrator, designed for carrying a heavy current, in series with

a ten volt storage battery, a key and one side of an induction coil. The other side of the induction coil is run out to the grounds.

These grounds are usually made up of five or six ground rods each stuck into the ground about six inches. The distance between grounds varies, depending to a great extent on the nature and condition of the soil. A total resistance of fifty ohms in the entire circuit was found to be most satisfactory, which corresponds to a length of base from fifty to one hundred and fifty yards. The frequency of the vibrator is adjustable between 250 and 800 vibrations per second by means of weights being attached to the vibrator itself.

The receiving circuit is longer than the sending circuit when used alone, varying from 100 to 200



Receiving set

yards. Because an ordinary telephone receiver is not sensitive enough an amplifier is always connected in the circuit. The French use a three step amplifier but the Americans have developed a two step amplifier with the same power of amplification.

Strangely enough, up to the time that the Americans entered the war the French had used only the one way set. Infantry battalions were equipped with sets for transmitting messages to the regiment but they had no means of knowing whether their message had been received or not. The reason, they claimed, was that the amplifier was too delicate an instrument to use forward of the regimental headquarters. The Americans, however, installed sending and receiving sets at practically all battalion and regimental headquarters and in many cases the apparatus more than justified its development.

Conditions of Operation

The range of the ground-telegraph is dependent largely on the condition of the soil and the relative positions of the bases. The soil should not be wet enough to short circuit the current through it nor should it be so dry as to cause the resistance of the earth to cut down the current to any great extent. The common range over which the system was used was from two to three kilometers (one to two miles) but there is no reason why the apparatus cannot be developed further. The best relative positions of the bases was found to be opposite and parallel, that is, the line connecting the centers of both bases should be perpendicular to both. If that is impossible the condition that both bases be chords of the same circle should be fulfilled.

Applications in Civil Life

Although the ground telegraph is a development of warfare there is no doubt in my mind but that it will be applied in civil life. It can be installed as an alternate to the telephone in places where wire communication is liable to destruction by storm. Again, a small hand set may be developed which can be carried by engineering parties through which they can be kept in constant touch with their headquarters. Necessity in other lines may also find a solution in the ground telegraph.

PROPOSED IRRIGATION DISTRICT POWER PROJECT

The proposed Don Pedro dam, to be installed four miles above La Grange, where a reservoir and power plant are also planned by which it is hoped eventually to water 240,000 acres of irrigable land in the Modesto and Turlock irrigation districts, is briefly outlined in the report of the consulting engineer.

The dam, power plant and reservoir will cost in the neighborhood of $3,489,000. The dam will be 279 feet high, not including 10 feet of masonry to be put in the bottom of the rock bed of the Tuolumne river to act as a cut-off wall. The base will be 177 feet. The dam will be of the arch type, and the masonry will taper from a 16-foot top. On this top there will be a roadway 1000 feet long. The dam complete will cost $2,880,000.

The project includes the construction of an eight-mile railroad to haul supplies, labor and materials to the scene of the work. This railway will connect with the Sierra road at Rosasco, 39 miles above Oakdale. It will cost $93,000.

The power plant, which is to be located below the dam, is estimated at $609,000 complete. It will have a capacity of 16,000 horsepower and 12,000 kilowatts. A storage capacity of 250,000 acre feet is planned for the reservoir, which will be available during the fall months when the canals are dry. Appropriations have already been secured by the two districts to be served by priorities of location dating back several years. The dam and reservoir will be built first, and then the power plant.

River records kept for 23 years near the present La Grange dam show that during all that time there were but four years in which the water supply was less than is needed to irrigate the proposed 240,000 acres to be watered under the project proposed. In all this time there was but one year when the shortage would have been serious.

At present 160,000 acres are being irrigated in the two districts. The dam, reservoir and power plant will equip the area to be served with facilities for assuring water all the year round for the entire 240,000 acres, or an additional 80,000 acres over what are now being served with water. Cheap power for lighting, pumping, farm work and irrigation purposes will also be served the district.

The average discharge of the Tuolumne river is 2,096,000 acre feet, and the average silt deposit at the above ratio will be 314 acre feet per year. According to the report it would take 40 years to fill up the bottom of the river channel not considered in the capacity of 250,000 acre feet assumed as the net capacity.

DIFFICULTIES IN ELECTRIC HOUSE HEATING

BY JOSEPH F. MERRILL

(The day when a house—or a city—may be built without a chimney is a pleasant picture to look forward to. But with all our interest in the extension of the use of electricity it is necessary to look practical considerations squarely in the face. It is obvious from the figures given below that electric house-heating is not a practicable load for the average power company—nor is it likely to become so without radical advances in the economical generation of electricity. The author is director of the schools of Mining and Engineering of the University of Utah.—The Editor.)

Legitimate Uses of Electricity for Heating

There are, of course, well known and very successful applications of electric heat to household appliances. These will not be discussed here, except to distinguish them from the problem here to be discussed. The electric range, flatiron, and similar appliances, are illustrations. Here the heating element is placed directly at the point where the heat is desired, and the entire heat output of the element is efficiently used in contradistinction to use of a stove for similar work, in which the larger part of the heat is wasted in firing up, and in escaping to the room and the chimney. Thus, notwithstanding the greater cost of a thermally equivalent amount of electricity as compared with coal, the increased efficiency of the former outweighs other considerations, and reduces the cost of the electric use to the point comparable with coal costs.

For illustration, a coal range must be fired long before the cooking time, so as to bring the surface or the oven to a temperature ready for cooking, and the coal continues to burn after the food is cooked. It has been estimated that not more than 1% of the heat value of the coal is actually applied to cooking in the ordinary range. On the other hand, the electric range becomes hot almost immediately, and operates at close to 100% efficiency in delivering the heat to the cooking utensils. Practically none of the heat escapes to the kitchen.

It is therefore important in considering the feasibility of electric air heating not to confuse the problem with electric cooking and similar uses.

The Central Heating Plant

For convenience in use and attractiveness to the consumer, electric air heating can be best compared with central district steam heating, which will yield the consumer the same freedom from personal care and responsibility. It may be safely affirmed that not one person in a hundred would pay any more for electric air heating than for central district steam heating. The latter, furthermore, affords actual basis of comparison because it is in successful use and operation both from a thermal or heat giving standpoint, and from an economic or financial standpoint in many cities.

Costs of a Central Steam Heating

Records of operation of a central district steam heating plant, heating several buildings in the business district of Salt Lake City, yield the following results:

Space heated (cubic feet)	8,187,000	
Capacity of plant, maximum demand	600 Boiler h.p.	
Steam generated (per year)	60,000,000 lbs.	
Steam sold (per year)	48,310,000 lbs.	
Overall thermal efficiency (Boiler Furnace 53%, Transmission 80%)	42.4 %	
Coal Consumption (quantity)	4,744 tons	
Coal Consumption (Price, $2.97 per ton)	$14,069	
Steam generated per 1000 cu. ft. space heated	7,330 lbs.	
B.t.u.'s delivered per 1000 cu. ft. space heated (1000 B.t.u.'s per lb. steam)	5,900,820 B.t.u.'s	
Coal required in boiler for 1000 cu. ft. space heated	1,160 lbs.	
Operating cost (12 mos. ending Oct. 31, 1918)	$29,525	
Operating cost per 1000 cu. ft. space heated (per year)		$3.60
Operating cost per 1000 lbs. steam sold		.61
Investment (physical valuation)	$140,000.00	
Fixed charges:		
Interest 7%		
Depreciation 3%		
Taxes and Insurance 2% — 12%	16,800.00	
Fixed charges per 1000 cu. ft. space heated		$2.05
Fixed charges per 1000 lbs. steam sold		.35
Total costs:		
Per 1000 lbs. steam		$0.96
Per 1000 cu. ft.		5.65

Costs of Electric Heating

Let us compare these costs with the cost of delivering from the same plant an equivalent amount of electric heat. As a preliminary, some fixed notions of relative values must be obtained. A kilowatt hour of electricity yields 3412 B.t.u's. On the other hand, as compared with this, one boiler-horsepower, by definition, yields 33,524 B.t.u. per hour. Consequently, one boiler-horsepower yields very approximately the same heat value as 10 kilowatts of electric capacity yields per hour, and this ratio is a ready reference rule of thumb frequently used by steam engineers. This, of course, is the thermal equivalence of the respective units, and has no reference to equivalence or disparity in mechanical energy.

From this relation it becomes apparent that to deliver the 600 boiler h.p. of heat by electricity will require a 6,000 kilowatt generating plant, whether steam or water power. Using our figures previously developed, $75.00 per kw., 6,000 kilowatts of steam capacity in Salt Lake City would increase the capital investment to $450,000 for plant capacity alone, exclusive of the distribution system, included in the capital investment of $150,000 for district steam plant. The capital investment for a hydro-electric plant would be from two to four times this amount, exclusive of transmission and distribution.

To find the cost of coal required to operate this steam-electric plant we will assume a modern high efficiency installation yielding one kilowatt-hour per two pounds of coal. Since one pound of steam yields 1000 B.t.u.'s and there were 48,310,000 lbs. of steam delivered, and one kw-hr. is equivalent to 3,412 B.t.u.'s, we learn 48,310,000 times 1000 divided by 3,412 equals 14,158,851, the number of kilowatt hours to be delivered, requiring a coal consumption of 14,159 tons, or 3460 lbs. per thousand of cubic feet of space to be heated.

The total coal bill for the operations of this plant would therefore become $42,052.00 against $14,069.00, and the coal bill per thousand cubic feet of space to be heated would be $5.14.

The operating costs of a steam generating plant may be roughly calculated by the rule of thumb that the coal bill is 70% of the costs. This will be found to be a very approximately correct ratio. Hence, total operating costs of this plant, converted to an electric generating plant, would be $42,052.00 times $\frac{100}{70} = \$60,075.00$.

Our total operating expense per thousand lbs. of steam equivalent delivered would thus become $1.25, or per thousand cubic feet of space heated, $7.34; and the fixed charges (12% on $450,000.00) $1.12 and $6.59 respectively, yielding a total cost of energy equivalent to one thousand pounds of steam delivered of $2.37, or per thousand cubic feet of space to be heated, $13.93.

It should be remarked that the steam cost above given, 96c per 1000 lbs. of steam, which yields the cost of $5.65 per thousand feet of space to be heated, is in excess of the value of service, as experienced by the operator of this plant, and that the actual heating rate is, and for several years has been not more than, 70c per thousand pounds of steam, which would give an equivalent of (70 : 96 = 5.47) approximately $4.00 per thousand cubic feet of space heated. Probably the deficit has been customarily ultimately absorbed in rents. But this is unimportant for the purpose of our study. The essential point is that the cost of electric heating to users from this plant would be almost exactly 3½ times what they are now paying for steam heating.

It has already been established that hydro-electric costs of production per kilowatt hour are, even in this country, approximately the same as steam costs, taking into consideration the various disparate elements in the two problems. And if this is true, it follows from the foregoing comparison of relative costs that a hydro-electric plant cannot be used to deliver a heating load on any possible commercial basis.

Summarizing what has been said before as to hydro-electric costs, and disregarding all comparison with costs of generating electric power by steam, this becomes apparent from the following estimate of these costs:

Capital investment	$200.00 per kw.
Fixed charges (interest, depreciation, insurance, taxes) 12%	24.00 per year
Operating costs	.....
Plant output (operated at 50% load factor), kw-hr	4380 hours
Cost per kw-hr. fixed charges alone ($\frac{24.00}{4380}$)	0.55c per kw-hr.
Required to deliver 5,900,820 B.t.u.'s or heat required for 1000 cu. ft. space*	2160 kw-hr.
Required to deliver 1,000,000 B.t.u.'s or equivalent 1000 lbs. steam*	367 kw-hr.
Fixed charge cost to deliver at plant switchboard heat for 1000 cu. ft. space	$11.88
Fixed charge cost to deliver heat at plant switchboard, equivalent to 1000 lbs. steam	$2.02

*Transmission and distribution losses 20%.

Further Disadvantages

Comparing this cost, which is, of course, inadequate in that it omits not only all operating expense but also all transmission and distribution charges, and expenses, it will be seen that the ratio between the cost of the same amount of heating delivered from a modern district steam system, and from a modern hydro-electric plant, would be (on the basis of 1000 cubic feet of space heated) as $5.65 is to $11.88, or as 1 is to 2.1, and on the basis of heating equivalent of 1000 lbs. of steam as $0.96 is to $2.02, or as 1 is to 2.1 for the heating season. If operating, transmission and distribution costs for the hydro-electric system were added, the ratio would be greater than 4 to 1, probably nearer 5 to 1.

Furthermore, throughout this study it is assumed that the heating load merely carries its own proportionate kilowatt hour burden, that is to say, that a load is found for the plant during the summer months, or the off heating season. It is difficult to believe that this assumption would correspond to facts. Obviously, in a normal system, the heating load comes on the system's annual peak, that is, during the winter months, when the lighting load is the heaviest. Power consumers cannot take power for three, four or five months of the year, but must have a continuous supply. Consequently, the heating capacity would not be available to carry commercial power loads. The only possible load to be carried as a complement to the heating load would be the summer irrigation load, which, however, would require a distinct investment in transmission lines, and like facilities, far distant from the towns where the heating work is done, and furthermore, in proper central station economics, an irrigation load should be an off-peak load, complementing the high priced winter lighting load, because the irrigation load itself cannot stand its own share of the fixed charges and cost of operating the plant, as it is distinctly a low value service. At the rates prevalent in Utah, and those which I have seen in Idaho, an irrigation load will yield, at the maximum, approximately $18.00 a horsepower per year, which is only about three-fourths of the fixed charges of plant alone, on the basis of calculations which I have used, that is to say, 12% total on $200 per kilowatt of capacity.

However, it is unnecessary to pursue this subject further, as the study assumes that the company is in some way provided a load which will carry the fixed charges and cost of plant operations during the no-heating months.

A Typical Case of House Heating by Electricity

Let us asume a five or six room bungalow cottage, of the design common in the smaller towns (and also in the cities) of Utah and southeastern Idaho. It would have a heating exposure of about 25 x 15 x 40 feet, or 15,000 cubic feet, and would require, to be comfortably heated in zero weather, an installation of 15 kilowatts delivered to the house. With 25% line and transformer losses from the plant to the house, this would require 20 kilowatts capacity at the central station. At a cost of $200.00 per kilowatt, this would require $4000.000 investment in plant capacity alone, to which line, substation and distribution capacity would add at least $100.00 per kilowatt of station capacity, thus giving a total investment of $6000.000 for heating plant for this house. If we assume, as we have heretofore

done, that this capacity could be otherwise utilized for one-half of the year, we would still have an investment of $3000.00 in heating plant for our house with fixed charges at 12%, amounting to $360.00 per year, to which operating costs must be added. To state accurately what these operating costs would be would require a careful analysis of modern station practice, which I have not had an opportunity to make. The larger part of these costs are incurred beyond the plant switchboard in transmission and distribution, and vary with the particular transmission and distribution systems. Station output costs are disclosed by operating reports of various stations.

The Thirteenth Annual Report of the Reclamation Service, page 35, gives the output cost of the Minidoka plant for the year 1913 (multiplying the kilowatt output by the cost per kilowatt hour, and dividing by the rated capacity) at a trifle over $5.00 per kilowatt. (This low cost is possible because no interest, taxes or insurance is charged.) The actual costs of distribution per kilowatt sold would probably be at least three times this amount.

If we charge but half of an aggregate cost of $20.00 to the heating load, the cost of delivering 15 kilowatts to residence heating appliances is increased by $150.00, giving a total cost of $510.00 for heating a five room cottage. The same quantity of heat would be produced by direct heating apparatus in the house from approximately 10 tons of coal, at a cost of about $80.00.

In this statement I have assumed the fixed charges to aggregate 12%. This would allow 6½% interest, 3½% depreciation, 2% taxes and insurance. If the state should own and operate power plants, and could finance such plants with money borrowed at 4½%, it could save about 4% in interest and taxes, or about $16.00 per year per kilowatt of capacity delivered, in fixed charges. This, however, would affect our heating load on the assumptions made above only by one-half of this amount, or $8.00 per year per kilowatt, or $120.00 per year per residence having 15 kilowatts demand, giving us a net heating bill for one of these residences of about $390.00 as against $510.00. So too, if it be contended that the installation costs assumed here are too high, it would make very little difference, from a practical standpoint, if the percentage of error should be as high as 50% in the total installation, because that would decrease the fixed charges only by one-third, or to $240.00 for a 15 kilowatt heating plant in private ownership, or $160.00 under state ownership. The operating expense would still remain the same, giving a heating cost of $310.00 to $390.00. However, I am confident that my former figures are much more nearly correct for continuous load capacity of stations as distinguished from mere rated capacity of machines, or mean flow of streams, than my latter.

Compared with Coal

Another way of attacking the problem is to find the electric heat equivalent of one ton of bituminous coal and to find at what price electric energy would have to be sold to make electric heat the same price as heat from coal.

Let us assume a house heating plant to have 60% efficiency, that a ton of coal costs $10.00 and that one pound of coal has 12,000 B.t.u.'s. Then there would be delivered from one ton of coal $12000 \times 2{,}000 \times 0.6 = 14{,}400{,}000$ B.t.u.'s, which divided by $3412 = 4220$ kw-hr. equivalent to one ton of coal. This would have to be sold at the electric heater for $10.00 or 0.23c per kw-hr., which is impossible, commercially considered.

The problem of heating on any extensive scale would be very much complicated by the very sparse use of heating appliances. If it be assumed that a few well-to-do people in the town could pay from $375.00 to $650.00 a year for heating a small residence, they would be so very few that the installation required for their service would be rendered still more disproportionate in cost to the value of the service rendered by the lack of use of these facilities by their poorer neighbors, so that the heating costs must be recalculated again to a figure where even the favored few would find the heating service too costly to be practicable.

ELECTRIFYING ITALY'S RAILWAYS

Great savings in the use of coal, according to the Italian Bureau of Public Information, have been effected in Italy in the past few years through the electrization of railroads and harnessing the water-power of the country to generate electricity. The percentage of railroads electrified in Italy from 1900-1915 is greater than in any other European country, and the economies resulting have been gratifying.

Electric traction of railroads began in Italy in 1900 with installations on the Varesina Line, which runs through Milan, Gallarate, Varese and Ponteceresio, and on the Valtellinese Line which runs from Lecco to Chiavenna.

Railways which run on mountainous routes and carry heavy trains have been installed with different systems. The principal mountain routes electrified are the Moncenisio Line, the Ceva-Port Savona Line, the old line of Giovi and the new supplementary Giovi line. These cover some of the most difficult territories traversed by any of the railroads in Europe.

The Moncenisio Line is the longest of the mountain railways. It is 8.5 miles long, travels at an altitude of more than 1,000 yards above sea level and is continuously on the ascent. It has a nominal carrying capacity of 640,000,000 tons per mile and actually carries 240,000,000 tons. The Ceva-Port Savona Line is a series of steep inclines and declines. The Giovi Line has the most rapid descent of any railroad in Europe and the supplementary Giovi Line carries the heaviest traffic in Italy.

The perfect systems installed on these mountain routes has made possible the increase in the carrying capacity and speed of the railways. There is at present under consideration the electrification of 1,250 miles more of railways.

DATA ON CENTRAL STATIONS IN THE WEST

Preliminary figures on central electric light and power stations in several of the western states have been issued by the Bureau of the Census. They were prepared under the supervision of Eugene F. Hartley, Chief Statistician for Manufactures.

The statistics relate to the years ending December 31, 1917, 1912 and 1907, and cover both commercial and municipal plants. They do not, however, cover electric plants operated by factories, hotels, etc., which generate current for their own consumption; those operated by the Federal Government and state institutions; and those that were idle or in course of construction.

ELECTRIC LIGHT AND POWER STATIONS: NEW MEXICO, 1917

	1917	1912	1907	Per cent of increase (1) 1907-1917	1912-1917	1907-1912
Number of establishments	29	21	15	93.3	38.1	40.0
Commercial	25	18	15	66.7	38.9	20.0
Municipal	4	3	....	....	33.3	....
Income	$894,207	$497,895	$292,682	205.5	79.6	70.1
Electric service	$874,317	$488,422	$289,962	201.5	79.0	68.4
All other	$ 19,890	$ 9,473	$ 2,720	631.2	110.0	248.3
Total expenses, including salaries and wages	$844,575	$449,516	$226,937	272.2	87.9	98.1
Number of persons employed	256	158	83	208.4	62.0	90.4
Salaries and wages	$223,510	$119,088	$ 66,981	233.7	87.7	77.8
Total horsepower	17,108	11,015	4,548	276.2	55.3	142.2
Steam engines:						
Number	37	32	26	42.3	15.6	23.1
Horsepower	13,226	8,428	4,035	227.8	56.9	108.9
Internal-combustion engines:						
Number	22	9	....	....	144.4	....
Horsepower	3,252	1,770	....	....	83.7	....
Water wheels:						
Number	7	9	6	16.7	—22.2	50.0
Horsepower	630	817	513	22.8	—22.9	59.2
Kilowatt capacity of dynamos	12,713	7,981	3,789	235.5	59.3	110.6
Output of stations, kilowatt hours	17,244,768	9,027,824	4,614,349	273.7	91.0	95.6
Stationary motors served:						
Number	729	439	195	273.8	14.1	227.7
Horsepower	7,626	4,084	1,231	519.5	86.7	231.8
Number of street lamps:						
Arc	13	247	(2)	....	—94.7	....
Incandescent, etc.	2,288	627	(2)	....	264.7	....

(1) A minus sign (—) denotes decrease.
(2) Not available.

The figures presented for New Mexico show substantial gains for each five-year period. From 1912 to 1917 the income increased $396,312, or 79.6 per cent, compared with a gain of $205,213, or 70.1 per cent, from 1907 to 1912. From 1912 to 1917 also the actual increase in expenses, $395,059, or 87.9 per cent, was greater than from 1907 to 1912, when the gain was $222,579, or 98.1 per cent. From 1912 to 1917 the output of stations increased 8,216,944 kilowatt hours, or 91 per cent, compared with a gain of 4,413,475 kilowatt hours, or 95.6 per cent, from 1907 to 1912. The actual increase in dynamo capacity was greater from 1912 to 1917 than for the prior five-year period, but the percentage of increase was less for the later than for the earlier period. In harmony with the showing for street lamps in most of the states, the use of arc lamps for street lighting shows a decided decrease from 1912 to 1917.

ELECTRIC LIGHT AND POWER STATIONS: OREGON, 1917

	1917	1912	1907	Per cent of increase (1) 1907-1917	1912-1917	1907-1912
Number of establishments	68	66	61	11.5	3.0	8.2
Commercial	53	54	50	6.0	—1.9	8.0
Municipal	15	12	11	36.4	25.0	9.1
Income	$2,577,297	$1,422,703	$1,965,245	31.1	81.2	—27.6
Electric service	$2,454,047	$1,380,785	$1,840,155	33.4	77.7	—25.0
All other	$ 123,250	$ 41,918	$ 125,090	—1.5	194.0	—66.5
Total expenses, including salaries and wages	$2,276,169	$1,205,738	$1,283,560	77.3	88.8	— 6.1
Number of persons employed	636	(4) 532	467	36.2	19.5	13.9
Salaries and wages	$ 583,195	$ 387,119	$ 416,424	40.0	50.6	— 7.0
Total horsepower	68,706	46,015	126,815	—45.8	49.3	—63.7
Steam engines:						
Number	46	54	66	—30.3	—14.8	—18.2
Horsepower	27,062	15,879	24,581	10.1	70.4	—35.4
Internal-combustion engines:						
Number	15	9	6	150.0	66.7	50.0
Horsepower	578	334	182	217.6	73.1	83.5
Water wheels:						
Number	80	60	72	11.1	33.3	—16.7
Horsepower	41,066	29,802	102,052	—59.8	37.8	—70.8
Kilowatt capacity of dynamos	47,917	32,416	32,587	47.0	47.8	— 0.5
Output of stations, kilowatt hours	107,886,973	58,789,342	92,807,992	16.2	83.5	—36.7
Stationary motors served:						
Number	3,284	1,527	2,072	58.5	115.1	—26.3
Horsepower	31,682	15,843	20,452	54.9	100.0	—22.5
Number of street lamps:						
Arc	489	1,128	(5)	....	—56.6	....
Incandescent, etc.	10,363	6,239	(5)	....	66.1	....

(1) The decrease from 1907-1912 is due to the fact that certain companies, included among the central stations for 1907, were later taken over by the railways and are included with the electric railway industry for 1912.
(2) A minus sign (—) denotes decrease.
(3) Exclusive of $2,047,853 in 1917 and $2,327,822 in 1912, reported by street and electric railway companies as income from sale of electric current.
(4) Includes approximately 100 part-time employes.
(5) Not available.

The figures presented for the state are fairly comparable for 1912 and 1917. The decreases shown for the period 1907-1912 are due mainly to the fact that certain establishments reported as central electric light and power stations for 1907 were later taken over by electric railways and were therefore reported with them for 1912 and 1917. From 1912 to 1917 the total income increased by $1,154,594, or 81.2 per cent; the expenses, by $1,070,431, or 88.8 per cent; the horsepower, by 22,691, or 49.3 per cent; the kilowatt capacity of the dynamos, by 15,501, or 47.8 per cent; and the output of stations, by 49,097,631 kilowatt hours, or 83.5 per cent. As in in the cases of practically all the states, the use of arc lamps for street lighting shows a pronounced decrease.

ELECTRIC LIGHT AND POWER STATIONS: NEVADA, 1917

	1917	1912	1907	Per cent of increase (1) 1907-1917	1912-1917	1907-1912
Number of establishments	14	8	9	55.6	75.0	—11.1
Commercial	13	7	9	44.4	85.7	—22.2
Municipal	1	1	....	....	....	....
Income	$ 938,929	$ 618,942	$ 372,108	152.3	51.7	66.3
Electric service	$ 833,088	$ 607,597	$ 352,959	136.0	37.1	72.1
All other	$ 105,841	$ 11,345	$ 19,149	452.7	832.9	—40.8
Total expenses, including salaries and wages	$ 662,359	$ 428,255	$ 245,291	170.0	54.7	74.6
Number of persons employed	190	147	78	143.6	29.3	88.5
Salaries and wages	$ 144,012	$ 113,636	$ 77,264	86.4	26.7	47.1
Total horsepower	16,832	15,420	6,980	141.1	9.2	120.9
Steam engines:						
Number	5	6	4	25.0	—16.7	50.0
Horsepower	1,100	2,210	235	368.1	—50.2	840.4
Internal-combustion engines:						
Number	8	8	6	33.3	....	33.3
Horsepower	617	670	485	27.2	— 7.9	38.1
Water wheels:						
Number	21	13	9	133.3	61.5	44.4
Horsepower	15,115	12,540	6,260	141.5	20.5	100.3
Kilowatt capacity of dynamos	12,353	10,513	5,690	117.1	17.5	84.8
Output of stations, kilowatt hours	53,846,178	44,969,772	29,621,730	81.8	19.7	51.8
Stationary motors served:						
Number	970	553	411	136.0	75.4	34.5
Horsepower	15,874	12,334	6,850	131.7	28.2	80.8
Number of street lamps:						
Arc	14	204	(2)	....	—93.1	....
Incandescent, etc.	1,003	401	(2)	....	150.1	....

(1) A minus sign (—) denotes decrease.
(2) Not available.

The figures show general increases at each succeeding census. As a rule, however, the gains are greater for the later five-year period. From 1907 to 1912 the number of establishments decreased from 9 to 8, but from 1912 to 1917 it increased to 14. The income and expenses increased during both five-year periods, and it is noticeable that the percentage of increase in expenses was greater than that for income; from 1912 to 1917 the income increased $319,987, or 51.7 per cent, and the expenses $234,104, or 54.7 per cent; from 1907 to 1912 the increase in income amounted to $246,834, or 66.3 per cent, and in expenses to $182,964, or 74.6 per cent. From 1907 to 1912 there was an increase in each of the three classes of power shown, but from 1912 to 1917 the horsepower of steam units and of internal-combustion engines decreased, while that of water wheels increased 2,575 horsepower, or 20.5 per cent. From 1912 to 1917 the output of stations increased 8,876,406 kilowatt hours, or 19.7 per cent, compared with an increase of 15,348,042 kilowatt hours, or 51.8 per cent, from 1907 to 1912. In common with other states, Nevada shows decreased use of arc lamps for street lighting purposes.

ELECTRIC LIGHT AND POWER STATIONS: UTAH, 1917

	1917	1912	1907	Per cent of increase (1) 1907-1917	1912-1917	1907-1912
Number of establishments	47	45	31	51.6	4.4	45.2
Commercial	25	28	22	13.6	—10.7	27.3
Municipal	22	17	9	144.4	29.4	88.9
Income	$5,444,807	$1,549,265	$665,241	718.5	251.4	132.9
Electric service	$4,965,930	$1,530,060	$627,332	691.6	224.5	143.9
All other	$ 478,877	$ 19,205	$ 37,909	1163.2	2393.5	—49.3
Total expenses, including salaries and wages	$4,018,963	$1,206,729	$461,675	770.5	233.0	161.4
Number of persons employed	1,215	401	198	513.6	203.0	102.5
Salaries and wages	$ 937,869	$ 365,399	$159,686	487.3	156.7	128.8
Total horsepower	226,595	60,588	35,950	530.3	274.0	68.5
Steam engines:						
Number	15	6	10	50.0	150.0	—40.0
Horsepower	54,189	1,000	1,279	2573.1	5318.9	—21.8
Internal-combustion engines:						
Number	.....	.....	.....	....	....	....
Horsepower	.....	.....	.....	....	....	....
Water wheels:						
Number	112	63	45	148.9	77.8	40.0
Horsepower	192,406	59,588	34,671	454.9	222.9	71.9
Kilowatt capacity of dynamos	147,359	37,935	33,592	338.7	288.5	12.9
Output of stations, kilowatt hours	466,995,136	86,634,658	61,672,661	657.2	439.0	40.5
Stationary motors served:						
Number	1,046	1,044	406	157.6	0.2	157.1
Horsepower	126,555	37,490	5,519	2193.1	237.6	579.3
Number of street lamps:						
Arc	2,635	321	(2)	....	721.8	....
Incandescent, etc.	7,697	5,237	(2)	....	47.0	....

(1) A minus sign (—) denotes decrease.
(2) Not available.

The figures presented for Utah show a remarkable growth in the central electric light and power stations, more pronounced during the later five-year period, from 1912 to 1917. The total number of companies reporting increased 14 from 1907 to 1912 and only two from 1912 to 1917. The number of stations, however, has but little significance because of the tendency to combine in a single system two or more plants that previously reported as independent stations. From 1912 to 1917 the income increased $3,895,542, or 251.4 per cent, compared with an increase of $844,024, or 132.9 per cent, from 1907 to 1912. The expenses increased correspondingly, 233 per cent and 161.4 per cent, respectively. From 1912 to 1917 the output of stations shows a gain of 360,360,478 kilowatt hours, or 439 per cent, compared with an increase of 24,997 kilowatt hours, or 40.5 per cent, from 1907 to 1912. The total horsepower increased 274 per cent and 68.5 per cent during the respective five-year periods. Unlike most of the states for which such figures are presented, Utah shows a large increase from 1912 to 1917 in the number of arc street lamps, the gain in incandescents being comparatively insignificant.

UNIVERSITY COOPERATIONS

(An editorial on "The New University" which appeared in the Journal of Electricity for Dec. 15, 1918, aroused considerable interest in university circles on the Pacific Coast. The following data on the activities of the University of Washington was sent in reply and is here reproduced as showing to what a great extent the modern university is today at work in the service of its community, living up to the ideals of cooperation suggested in the Journal of Electricity editorial.—The Editor.)

A university, because it deals with the most advanced phases of knowledge and discipline, acquires other functions than instruction. Every true university is an institution for scientific research. It seeks knowledge in its laboratories and beyond them in the real world of practical issues. That search for truth outside of academic walls requires the cooperation of many agencies, and a university becomes rich in significant knowledge if it has them.

The Great Worth of University Cooperations.—But there is another side to that intellectual cooperation. The new truths of science are valuable chiefly for their human uses—spiritual, social and economic. The routing of truth through the student's thought is indirect. It takes a long time to get into industry, commerce and other human affairs. It has an immediate service to the public to perform. It applies its facts and its methods to the problems of practical and responsible life, whenever an instrument of public welfare offers its cooperation.

The cooperations of the University of Washington are grouped as: (I) Cooperations with national agencies; (II) with the state; (III) with the municipality; (IV) in industry and commerce; (V) with colleges and universities; (VI) gifts; (VII) loans.

I. Cooperations with Federal Agencies

1.—Pacific Northwest Experiment Station, U. S. Bureau of Mines.—The United States Bureau of Mines maintains a mining and metallurgical experiment station for the Pacific Northwest and the coast regions of Alaska at the College of Mines. The headquarters of the station, from which all operations in this territory are directed, are in the Bureau of Mines Building, between Mines and Bagley halls. An analytical laboratory is in the same building, while the electric furnace and other equipment used by the bureau in cooperation with the college are housed in the Mines building. At present the principal investigations being conducted by the station are in electro-metallurgy, and in the mining, treatment and uses of coal.

2. Mines Rescue Training Station, U. S. Bureau of Mines.—The Mines Rescue Training Station of the United States Bureau of Mines occupies a separate building near the Mines Building. The "smoke-room," fitted with track and car, overcast airway and smudge floor, is the largest of its kind in the country. Several sets of rescue and resuscitation apparatus are kept on hand for practice as well as for use in mine rescue work, or emergencies such as asphyxiation, drowning, electric shock, and the like. A lamp-testing machine is in use for testing safety lamps in mixtures of gas and air under varying conditions of velocity; this machine is a duplicate of the one at the Pittsburg laboratory of the United States Bureau of Mines. A White automobile truck of 45 h.p., with a capacity of six men and six sets of rescue apparatus, is kept in constant readiness for service in the nearby mining fields of the state.

3. Timber Testing Laboratory, U. S. Forest Service.—Laboratory work in timber physics is carried on the U. S. Forest Service Timber Testing Laboratory, operated in cooperation with the University. This laboratory is magnificently equipped with seven large testing machines for static and impact loading, circular and band saws, planer and other shop equipment for wood-working.

4. Wood Distillation Plant, U. S. Forest Service.—This plant consists of a retort of one-half cord capacity per charge, gas tank, and refining apparatus. The purpose of this experimental station is to discover by-products which may become commercially profitable in this region.

5. Medicinal Plant Garden, U. S. Bureau of Plant Industry.

6. Pacific Northwest Research Station, U. S. Bureau of Education.

7. Cooperation with Federal Board for Vocational Education.

8. Navigation Schools, U. S. Shipping Board.

9. Marine Engineering School, U. S. Shipping Board.

10. Employment Management School, U. S. Industries Board.—The course in employment management was given at the express request and under the supervision of the industrial service sections of the several departments at Washington. It emphasizes the function of personnel management and the necessity of training groups of competent employment managers capable of maintaining the proper relations between employer and employe.

11. Cooperation with War Department.

12. Cooperation with the U. S. Navy.

13. Cooperation with the U. S. Marine Corps.

14. Special Investigations for the Federal Government Conducted by the College of Business Administration.—The college contributed a study of food prices to the Macey Commission on shipyard labor adjustments. The fuel administrator for the state of Washington called upon the college for a preliminary survey of the fuel problem and the methods to be used in solving it for the state. This investigation extended over a period of six weeks, and consisted of gathering statistical data which would serve as a basis for fuel prices. Considerable work was also done relative to the routing, loading and unloading of fuel.

The college investigated lumber camp conditions for Secretary of Labor Wilson's Mediation Commission.

An investigation of the fish industry was made for the State Food Administrator.

II. Cooperations with the State Government

Membership on State Boards.

State Geologist—Head of the Department of Geology.

State Chemist—Dean of the College of Pharmacy.

Special Investigations for State Department.

Cooperation with the State Commissioner of Fisheries—Several investigations were conducted by University specialists at the request of the State Commissioner of Fishieries.

Cooperation with the State Board of Health.

III. Municipal Cooperations

Observation and Supervised Teaching.

Practice Work in Library Economy.

Municipal Survey of Civil Service Wages.

IV. Cooperations with Commercial and Industrial Agencies

1. College of Business Administration.—During this biennium the staff of specialists associated with the Department of Economics and the School of Business Administration have at the request of various private or public agencies, cooperated upon problems of public import by making the following investigations or surveys:

(1) Cost of living survey from February 1 to July 1 for the flour milling employers and employes of Seattle.

(2) A survey for the Seattle Times Printing Company covering an investigation of the company's financial state-

ment, as well as an investigation of labor conditions and services in the various departments of the plant.

(3) Investigation of the Chinese Exclusion Act and labor conditions for the China Club of the city of Seattle.

(4) An investigation of rate schedules in the various cities of the United States for the Seattle Gas Company.

(5) For the Seattle Chamber of Commerce three studies were made:

a. An investigation relative to exports and imports at the Port of Seattle for the period of 1913 to 1918.

b. A survey of tonnage and shipbuilding conditions to be used for the shipbuilders of the Pacific Northwest.

c. A report on the trend of prices, credit extension, bank reserves, interest rate, and general banking conditions.

2. **University Engineering Experiment Station.**—The industrial cooperations of the University during the past biennium have been too numerous to state in detail. The Engineering Experiment Station has been organized for the special purpose of coordinating the efforts of all the technical departments which aim to solve in scientific terms the industrial problems of this region.

These studies have touched every line of industrial activity, and were designed to foster cooperation in research between individual firms or trade and industrial groups on the one hand and the University staff on the other.

CENTRAL STATION ADVERTISING

THE VALUE OF ADVERTISING to the electrical industry is well told by the story of the campaign of the Bartlesville Interurban Railway Company of Oklahoma for a seven cent fare. It only remains to be added that the increase was granted. This is how the superintendent of the company tells of the campaign:

Before entering upon this campaign we realized that we were giving poor service. However, we knew that before making any extensive repairs or purchasing additional equipment, additional revenue must be obtained in order to better our service. With these facts in mind we launched an advertising campaign with a view to putting our case directly up to the people and convincing them of our difficulty.

On June 11, 1918, we opened our campaign, running talks in both local papers. After the publication of six talks we found we were getting very little criticism except from some of the most prominent business men, and these criticisms were, for the most part, constructive.

In view of the fact that the bulk of the people apparently were not reading our talks we had posters painted, reading as follows:

"Is the Interurban Justified in Increasing Its Unit Street Car Fare from Five to Seven Cents? Read 'PUP' Talks in Both Papers and Offer Your Objection."

These posters were painted on 14 by 22 inch cardboard and carried inside the cars. The appearance of this poster did the work. Criticisms both constructive and destructive were frequent. The 7-cent fare became the topic of car riders, several letters were printed by the newspapers and we also received some personal letters. Before entering our campaign we were prepared for a long series of talks and any criticisms that might develop. However, after running 16 talks it seemed that we had accomplished our purpose and we closed the campaign.

We then drew up three resolutions, the general form of which was listed as the seventeenth talk. W. H. Merritt, general manager, first obtained the approval of the Bartlesville Chamber of Commerce to one resolution; then went to the Dewey commissioners and secured their approval and signatures to the second, and then went before the Bartlesville city commissioners and secured their approval and signatures to the third resolution. This was a wise and judicious move, and without a doubt contributed largely to the speedy and favorable action of the State Corporation Commission. L. A. Ramsay, then secretary of the company, carefully compiled a very complete, concise and clear statement of financial conditions, which was embodied in the petition for our increase. After this was done Messrs. Merritt and Ramsay in person presented our petition with the signed resolutions and a complete set of our 17 talks attached, to the State Corporation Commission. This presentation was made about July 2, and so pleased were the commissioners with the manner of presentation that we were permitted a hearing ahead of many cases filed before us. To be specific, our hearing was set for July 12, and at that time Messrs. Merritt and Ramsay again appeared before the Commission. No opposition was offered and they were practically assured of the commissioners' approval.

On July 19 we received authorization from the State Corporation Commission to put a 7-cent unit fare into effect on and after Aug. 1. On July 27 painted posters were placed in our cars notifying the public of the increase. On July 30 and 31 the newspaper ad. listed as our eighteenth talk was run and the fare became effective Aug. 1.

This we believe gives in detail our procedure in obtaining the 7-cent fare, and I can think of no higher compliment to pay Mr. Merritt than in citing these two facts:

1. Within 40 days after starting the campaign authorization was given for a 40% increase in street car fares.

2. The Corporation Commission said: "Never in our history have we had a better or more complete petition presented to us."

The matter used in the talks included: (1) Introduction; (2) Capital; (3) Comparative value of money, using 260 commodities; (4) Specific Cost increase; (5) Summary and definite statement of drive for increased fares; (6) Why the cost of operating a small utility is greater than that of a large one; (7) Reference to No. 6, and list of large cities having increased fare; (8) Business principles in regard to a special and fixed price; (9) General summary of past talks as an introduction to the correspondence between President Wilson and Secretary McAdoo; (10) Wilson-McAdoo correspondence; (11) Use of verse published in Doherty News; (12) Electric rapid transit — the union; (13) Letter from United States Chamber of Commerce; (14) Letter from John Skelton Williams, comptroller of the currency; (15) Extracts from Public Service Corporation and War Finance Corporation statements; (16) Closing Talk; (17) Publication of resolution, and (18) Announcing increase of fare.

ELECTRIC ARC WELDING

BY F. A. ANDERSON

(The importance which is being given the arc welding process in shipbuilding has brought this art forward into public interest. Althoug h on the whole it has been slow in development, arc welding has possibilities which have alrea dy greatly modified ship building and promise further developments. With this issue, the Jo urnal of Electricity initiates a series of authoritative articles on this subject. The author's experience as electrical inspector with the U. S. Government has given him opportunity to stud y the subject from almost every angle. He was connected in this capacity with one of the larg e shipyards of the East before coming to the Pacific Coast.—The Editor.)

The term "welding" is employed to denote the combination of two pieces of metal into a homogeneous whole by fusing them together. Heat is, therefore, an essential to the process and the term "electric welding" is applied to that form of welding in which the necessary heat is produced by means of an electric current.

In using the electric current to produce the required heat there are two main methods. The heat may be due to the passing of current through the resisting of metals in contact, or it may be produced by the electric arc.

Arc welding motor gear cases, showing the shield, and the method of operating

In resistance welding the metals to be welded are placed in contact and when the necessary temperature has been reached through the passing of the electric current, pressure is applied. At the same time the current is cut off. Spot and butt-welding are the principal methods employing the resistance process.

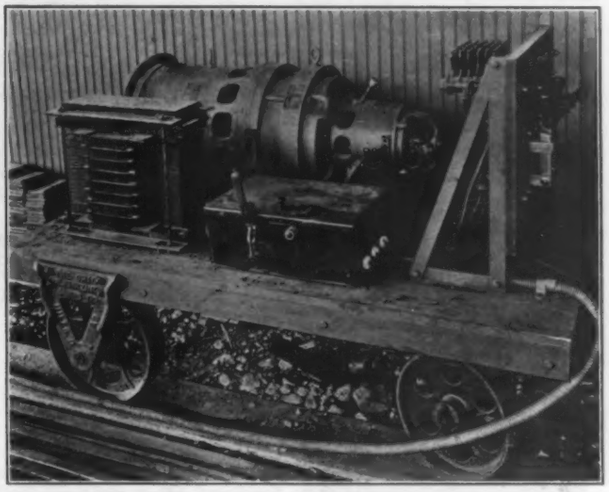
In arc welding, the necessary heat is gained from the electric arc, as the name implies. The actual technic of the process will be dealt with in future articles. At present we are concerned mainly with the different welding machines which have been and are now being used.

Three Processes —

It may be remarked, however, that there were originally three different arc welding processes, named after the inventors or early developers of the art. The processes have advanced so greatly since their first invention that the original names are hardly ever used now. In spite of the great progress which has been made in arc welding, much greater progress might have been made had it not been for two causes. The first is due to the fact that, until comparatively recent years, some manufacturers of electric arc-welding machines have been inclined to look upon their product as a sort of side line, hardly to be taken seriously; and the second to those who, accrediting unto themselves superiority, safeguarded their processes with a shield of mystery which might be compared with the protection afforded the casual observer from the glare of the arc.

The Zerener process employed positive and negative carbons in V form. The arc was forced toward the work to be welded by an electro magnet. The electrode or welding-rod was fed into the arc. This process is so rare now, however, that it is practically obsolete.

The second method was known as the Bernardos process. By this process a carbon was used for one side of the circuit, the other being formed by the work itself. No electric magnet was necessary. As



A self-contained one-man arc welding outfit mounted on a truck

in the Zerener process, the electrode was fed into the arc. This process is now more generally known as "carbon welding" and is quite extensively used on heavy work, in electric cutting and in certain cases where a more satisfactory union of the metals can thus be obtained.

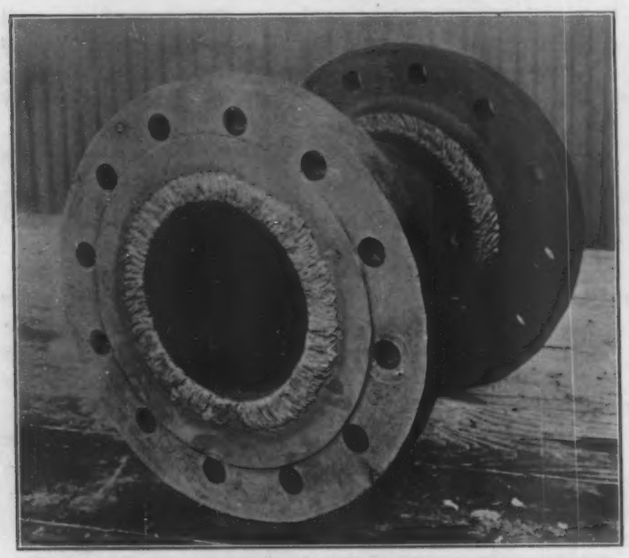
In the Slavianoff process the electrode, or welding-rod, itself forms one side of the circuit, which is completed by the work to be welded. The electrode melts by the heat of the arc and is fused directly with the other metal. This process is so commonly used now, that unless definitely qualified, the term "arc-welding" may be regarded as synonymous with the Slavianoff process.

There are four principal points from which electric arc-welding may be viewed: the machine,

the operator, the electrode and the material to be welded. It is with this first point that the present article is concerned. Later articles will deal with the other points in the order named.

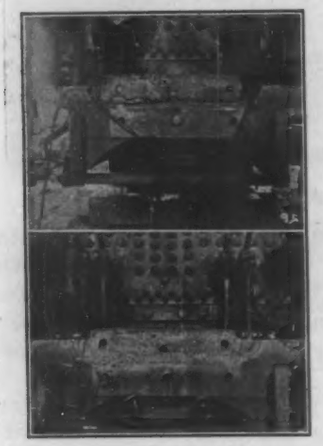
The Machines Employed —

In most arc welding work, the current required at the arc ranges from 80 to 180 amperes at from 12 to 25 volts, the higher amperage requiring the lower voltage. It is obvious, therefore, that there is a great deal of waste energy in the circuit which employs the usual 125 volts with resistance interposed to obtain the required drop. Yet this was the early method of attaining the desired result, and is in the present day still used by one process, which employs a coated electrode.



A typical arc weld

Gradually machines were developed for this kind of work. First came the motor generator in which the generated voltage ranged, according to make, from 60 to 80 volts. In each case the machine was flat compounded, delivering a constant voltage at all ranges of load, from zero to full. These machines were made in various sizes and accommodated from two to eight operators. The machines were known as two, five or eight men sets, according to the number of operators supplied.

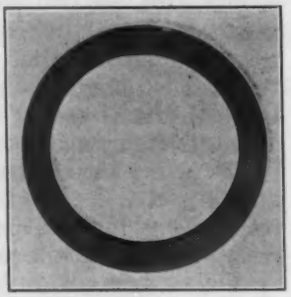


A locomotive tail piece before and after welding, indicating the type of problem solved by the arc welding process. The resulting weld is capable of withstanding severe strain.

For each operator there was provided a bank of resistance switches, contact devices, etc., in all a very elaborate installation, and one which resulted in a considerable saving of energy. The motor generator was usually located in some central place, with long heavy leads carried to the "welding stations" in much the same manner as a small power station. The initial cost was great, but in practically every instance they have proved a paying investment, and many are still in operation, rendering faithful and efficient service.

COPPER WELDED RING

One of the non-ferrous metals, hitherto supposed impossible of welding. Here is a sample of a very successful arc-weld. The area has not been reduced nor the ring in any way affected. It is impossible, in fact, to detect the point where the weld was made... This ring is on file in the office of the Journal of Electricity and may be inspected by anyone interested.



Probably the next development was a motor generator in which a lower voltage was generated, although the constant voltage principle was maintained. There was still, also, a large amount of resistance used in the arc circuit. These machines were a considerable improvement in that they were portable and could thus dispense with the great first cost of a central generating station and distribution system.

One machine was designed which used the dynamotor principle and another of motor-generator type which generated a voltage as low as 35 volts, although both used constant voltage and resistance in the arc circuit. This last-mentioned voltage is probably as low as it is safe to go, as less makes "striking the arc" very difficult. It would be more desirable, from this point of view, slightly to increase the voltage.

All of these systems use contacting devices and other appliances operated directly by or in unison with the arc.

Next there came into the field the one-man machine in the form of a specially designed motor-generator which dispensed with practically all resistance in the arc circuit. This generator was so arranged that it would give ample voltage on open circuit to strike the arc, and yet, under load the voltage would be reduced proportionally to the amperage drawn at the arc.

Machines such as this are known as constant wattage, variable voltage, or constant heat machines. They employ no contactors or automatically operating devices within the arc circuit. So far as is known there are only three types of machines similar to this at present manufactured. Each produces the result in a slightly different way, but all result in a greatly increased saving of hitherto wasted energy.

Another system uses the old series,—arc principle. It is designed to supply several operators and contemplates carrying a constant amperage, increasing the voltage for each operator. It depends on contact devices, resistance in circuit, coils in shunt

and series, for each operator. All of these must work in harmony to obtain success. This system reverts to the central station method, employing a three unit machine with variously located welding stations, but on account of increasing the volts instead of the amperes, the welding mains are not of so large capacity.

The machines herein described all employ direct current at the arc and most of them may be operated on the motor end from alternating current. They all possess merit and each claims for itself a particular adaptability to meet the varying demands of service.

It therefore rests with the engineer to determine his own requirements, to weigh the value of the central location and special distribution system against that of the more portable machine on an existing distribution system, to judge each machine for its ability to meet his particular service, and to consider its elasticity in relation to and in unison with his program of progress and development.

While alternating current is best adapted to resistance welding and has sometimes been used for producing the arc in arc-welding, it has never been a pronounced success for that purpose. In this and the following articles it will be assumed that direct current is used at the arc.

The next article will deal with the technic of the operator, upon which much of the success of the art depends.

FILING SYSTEM FOR CENTRAL STATION USE

BY C. C. HOGAN

(After much experimentation the Dewey Decimal System was decided on by the Southern Sierras Power Company as the only adequate basis for a filing system. The principles on which the adaptation was made were briefly stated in the February 15th issue of the Journal of Electricity. The actual system as adopted is here given as an example of how the general system may be fitted into the needs of a complex organization. The individual subdivisions will perhaps vary with the particular concern but the principles of the following tabulation will prove helpful and generally applicable.—The Editor.)

For the purpose of classifying and filing the correspondence of the associated companies of the Southern Sierras Power Company, a filing classification has been compiled, in which the decimal system of numbering subjects is used.

By this plan of numbering, all subjects that may arise in the course of the business are first segregated into seven general groups, or Divisions, such for instance as "100. Administration"; "200. Engineering"; "300. Operating"; etc. These Divisions are each assigned a series of one hundred numbers ("Hundreds") beginning with 000. and ending with 600.

Each Division is then subdivided into ten Sections by which the Primary subjects of each Division are segregated. The Sections are assigned the "Tens" series in each hundred, beginning with 00., followed by 10., 20., etc. The Primary subjects in all but "000. General" and "100. Administration" are for the most part composed of the different classes of business in which the associated companies are engaged, including "30. Electric," "40. Railway," "60. Ice," etc. The numbers assigned to Primary subjects are uniform throughout all Divisions (except "000. General" and "100. Administration") so that the "30." series always represents "Electric," "40." "Railway," etc., no matter in which Division appearing.

After segregating into Sections, the Primary subjects are then subdivided into Secondary Subjects, occupying the "Unit" position, viz., 1., 2., etc., there being available, of course, numerical positions for ten Secondary Subjects in each Section.

The classification given herewith, with few exceptions, ends with the Secondary Subjects (Units) thus providing in excess of five hundred subjects which it is believed is ample to satisfactorily care for the correspondence at most of the plants and stations. The complete classification in use at the general offices is worked out in much more detail, some subjects occupying the decimal thousandths position or lower.

000. General —

This Division, as the title signifies, is intended to carry such subjects of a miscellaneous or general character as cannot be assigned to either of the remaining six Divisions.

000. **Miscellaneous**
001. Associations
002. Civic Organizations
003. Clubs, Societies, etc.
004.
005.
006.
007.
008.
009.

010. **Contracts, Reports, etc.** (Miscellaneous)
011. Government Reports
012. Reports of Other Companies
013.
014.
015.
016.
017.
018.
019.

020. **Political.** (Miscellaneous)
021. Elections
022. Political Appointments
023.
024.
025.
026.
027.
028.
029.

030. **Legislation.** (Miscellaneous)
031. Federal Legislation
032. State Legislation
033. Territorial and Insular Legislation
034. County Legislation
035. Municipal Legislation
036.
037.
038.
039.

040. **Legal.** (Miscellaneous)
041. Legal Advice, Consultation, Routine
042. Decisions and Opinions
043. Litigation—Federal Courts and Commissions
044. Litigation—State Courts and Commissions
045. Litigation—Territorial and Insular Courts and Commissions
046. Litigation—County Courts and Commissions
047. Litigation—Municipal Courts and Commissions
048. Miscellaneous Litigation
049.

050. **Insurance.** (Miscellaneous)
051. Fire Insurance
052. Cyclone and Tornado Insurance
053. Burglary Insurance
054. Boiler Insurance
055. Employer's Liability Insurance

056. Life, Accident and Sick Benefit Insurance.
056.1 Employes Group Insurance
057. Automobile Insurance
058. Surety Bonds.
059.

060. **Accidents and Personal Injuries.** (Miscellaneous)
061. Accidents to Public
062. Accidents to Employes
063. Relations with Hospitals and Physicians
064. Personal Injury Claims
065.
066.
067.
068.
069.

070. **Publicity.** (Miscellaneous)
071. Company Publications
072. Other Company Publications
073. Advertising Publications
074. Financial Publications
075. Illuminating Signs, Slides, Flood Lights and Street Cars
076. Newspapers, Periodicals and Books
077. Government Publications
078.
079.

100. Administration —

This Division embraces such subjects as pertain to Incorporation, Organization and General Management.

100. **Miscellaneous**
101. Inspection Trips, Itineraries, etc.
102. Conferences, Meetings, etc.
103.
104.
105.
106.
107.
108.
109.

110. **Contracts, Reports, etc.** (Miscellaneous)
111. Permits and Privileges Granted
112. Annual Reports
113.
114.
115.
116.
117.
118.
119.

120. **Organization.** (Miscellaneous)
121. Acquirement of other Companies
121. Incorporations
123. Stockholders
124. Directors and Trustees
125. Executive Committees
126. Officers
127. Heads of Departments
128. Special Committees
129. Superintendents

130. **Employes.** (Miscellaneous)
131. Applications for Employment
132. Employments
133. Employes' Records
134. Transfers and Promotions
135. Resignations and Discharges
136. Employes' Organizations, Unions, etc.
137. Employes' Savings
138. Salaries and Wages
139.

140. **Office Management.** (Miscellaneous)
141. Offices
142. Office Work and Systems, Miscellaneous
142.1 Clerical Work
142.2 Stenographic Work
142.30 Correspondence
142.31 Mail—Including Telegrams
142.32 Mailing Lists and Addresses
142.33 Orders Regarding Mail
142.34 Lost Mail
142.35 Post Office Regulations
142.36 Archives—Filing Systems
142.37 Telegraph Code Books
142.4 Blank Forms
143.
144.
145.
146.
147.
148.
149.

150. **Executive Orders.** (Miscellaneous)
151. Orders Issued by Board
152. Orders Issued by Officers
153. Orders Issued by Department Heads
154. Orders Issued by Superintendents
155.
156.
157.
158.
159.

200. Engineering —

This Division includes subjects that relate to surveying, construction, alteration, maintenance, removal or dismantling of plants or equipment; including preparation of plans, specifications, drafting, blue printing and other engineering, office or field work that pertains thereto.

Subjects relating to use or operation of properties should be carried in the 300. series; those relating to Purchase, Title, Rental or Sale in the 500. series.

200. **Miscellaneous**
201. Maps, Blue Prints and Drawings
202. Construction Requisitions and Reports
203. Work and Job Orders
204.
205.
206.
207.
208.
209.

210. **Contracts, Reports, etc.** (Miscellaneous)
211. Plans and Specifications
212. Engineering Estimates
213. Progress and Inspection Reports
214. Preliminary Surveys
215.
216.
217.
218.
219.

220. **Non-Utility.** (Miscellaneous)
221. Real Estate (Unimproved)
222. Ranches, Farms, etc.
223. Industrial Enterprises
224.
225. Mining and Oil
226.
227.
228. Irrigation Enterprises
229. General Non-Utility Equipment and Supplies

230. **Electric.** (Miscellaneous)
231. Hydro Power Plants
232. Steam Power Plants
233. Gas and Oil Engine Power Plants
234. Auxiliary Storage Batteries
235. Transmission Lines
236. Distribution Lines
237. Sub-Stations
238. Electric Services, Customers' Installations
239. General Electric Buildings and Equipment

240. **Railway.** (Miscellaneous)
241. Real Estate, Station Houses
242. Shops and Engine Houses
243. Transfer and Turn-Tables, Cinder-Pits
244. Yards and Terminals
245. Freight Depots and Structures
246. Roadway, Track and Appurtenant Structures
247. Rolling Stock
248. Electric Power Transmission
249. General Railway Buildings and Equipment

260. **Ice.** (Miscellaneous)
261. Real Estate
262. Ice Manufacturing Plants
263. Ice Storage
264. Ice Delivery Equipment
265.
266.
267.
268.
269. General Ice Buildings and Supplies

280. **Water.** (Miscellaneous)
281. Real Estate
282. Pumping Stations, Hydraulic Works
283. Water Supply
284. Pollution and Purification
285. Transmission System
286. Distribution System
287.
288. Water Services, Customers' Installations
289. General Water Buildings and Supplies

290. **General.** (Miscellaneous)
291. Real Estate
292. General Buildings and Structures
293. Machine Shops, Garages and Stables
294. Roads, Bridges, and Highway Materials
295.0 Telephone and Telegraph (Miscellaneous)
295.1 Buildings and Structures
295.2 Telephone Exchanges
295.3
295.4
295.5 Long Distance Lines
295.6 Local Lines
295.7 Local Stations
295.8 Customers' Installations
295.9 General Telephone and Teleg. Equipment and Supplies
296 Vehicles and Accessories
297. Sidings and Switching Facilities
298. Construction Material and Equipment
299. General Stores and Supplies

300. Operating —

The Operating Division, as the word signifies, carries subjects relating to the operation or use of the properties owned, leased or controlled by the companies. It will also carry correspondence relating to the production, handling and sale of Agricultural Products (322.).

Subjects relating to Construction, Maintenance or Dismantling of properties belong to the 200. series; those relating to Purchase, Title, Rental or Sale, to the 500. series.

300. **Miscellaneous**
301. Patroling, Watching and Inspecting
302. Transportation, Routing and Billing
303. Operating Rules and Regulations
304. Service Interruptions, Storms, etc.
305. Relations with other Companies

306.
307.
308.
309.
310. **Contracts, Reports, etc.** (Miscellaneous)
311. Operating Contracts
312. Operating Estimates
313. Operating Reports
313.91 Auto Mileage Reports
314.
315. Inter-Company Contracts
316.
317.
318.
319.
320. **Non-Utility.** (Miscellaneous)
321. Real Estate (Unimproved)
322. Ranches, Farms and Agricultural Products
323. Industrial Enterprises
324.
325. Mining and Oil
326.
327.
328. Irrigation Enterprises
329. General Non-Utility Equipment and Supplies
330. **Electric.** (Miscellaneous)
331.0 Hydro Power Plants
331.01 Superintendence
332.0 Steam Power Plants
332.01 Superintendence
333.0 Gas and Oil Engine Power Plants
333.01 Superintendence
334. Auxiliary Storage Batteries
335. Transmission Lines
336. Distribution Lines
337.0 Sub-Stations
337.01 Superintendence
338.0 Electric Services, Customers' Installations
338.01 Testing Customers' Installations
338.02 Connects and Disconnects
339. General Electric Buildings and Equipment
340. **Railway.** (Miscellaneous)
341. Real Estate, Station Buildings
342. Shops and Engine Houses
343. Transfer and Turn-Tables, Cinder-Pits
344. Yards and Terminals
345. Freight Depots and Structures
346. Transportation
347. Traffic
348. Electric Power Transmission
349. General Railway Buildings and Equipment
360. **Ice.** (Miscellaneous)
361. Real Estate
362. Ice Manufacturing Plants
363. Ice Storage
364. Ice Delivery
365
366.
367.
368.
369. General Ice Buildings and Supplies
380. **Water.** (Miscellaneous)
381. Real Estate
382. Pumping Stations, Hydraulic Works
383. Water Supply
384. Pollution and Purification
385. Transmission System
386. Distribution System
387.
388. Water Services, Customers' Installations
389. General Water Buildings and Supplies
390. **General.** (Miscellaneous)
391. Real Estate
392. General Buildings and Structures
393. Machine Shops, Garages and Stables
394. Roads, Bridges and Highway Materials
395.0 Telephone and Telegraph (Miscellaneous)
395.1 Buildings and Structures
395.2 Telephone Exchanges
395.3
395.4
395.5 Long Distance Lines
395.6 Local Lines
395.7 Local Stations
395.8 Customers' Installations
395.9 General Telephone and Teleg. Equipment and Supplies
396. Vehicles, Accessories and Teams
397. Sidings and Switching Facilities
398.
399. General Stores and Supplies

400. Finance and Accounts —

The subjects carried in this Division embrace matters relating to the financial operations of the companies, and the reporting and recording thereof.

"Finances" include purchase and sale of Stocks, Bonds and other securities; Receipt and Disbursement of moneys; Banks and Banking; Investments; Taxes and Assessments.

"Accounts" embrace all matters relating to the assembling, reporting and recording of data relating to the financial transaction of the companies.

400.0 **Miscellaneous**
400.1 Accounting Methods—Instructions
401.
402.
403.
404.
405.
406.
407.
408.
409.
410. **Contracts, Reports, etc.** (Miscellaneous)
411. Financial Statements and Reports
412. Appraisals. (See Inventories 514.)
413. Budgets and Financial Estimates
414. Escrow Agreements
415. Underwriting Agreements
416. Mortgages and Trust Deeds
417.
418.
419. General Contracts and Reports
420. **Non-Utility.** (Miscellaneous)
421. Real Estate (Unimproved)
422. Ranches and Farms
423. Industrial Enterprises
424.
425. Mining and Oil
426.
427.
428. Irrigation Enterprises
429. General Non-Utility Finance and Accounts
430. **Electric.** (Miscellaneous)
431. Asset Accounts
432. Liability Accounts
433. Revenues
434. Expenses
435.
436.
437.
438.
439. General Electric Finance and Accounts
440. **Railway.** (Miscellaneous)
441. Assets Accounts
442. Liability Accounts
443. Revenues
444. Expenses
445.
446.
447.
448.
449. General Railway Finance and Accounts
460. **Ice.** (Miscellaneous)
461. Assets Accounts
462. Liability Accounts
463. Revenues
464. Expenses
465.
466.
467.
468.
469. General Ice Finance and Accounts
480. **Water.** (Miscellaneous)
481. Asset Accounts
482. Liability Accounts
483. Revenues
484. Expenses
485.
486.
487.
488.
489. General Water Finance and Accounts
490. **General.** (Miscellaneous)
491. Asset Accounts
492. Liability Accounts
493. Revenues
494.0 Expenses
494.1 Employes' Expense Accounts
495.0 Telephone and Telegraph (Miscellaneous)
495.1 Asset Accounts
495.2 Liability Accounts
495.3 Revenues
495.4 Expenses
495.5
495.6
495.7
495.8
495.9 General Telephone and Teleg. Finance and Accounts
496. Investment and Securities
497. New Financing
498. Taxes and Assessments
499. General Finance and Accounts

500. Properties —

This Division carries all subjects relating to the Purchase, Rental, Title, or Sale of Property and Equipment with the following exceptions:

"Commercial Appliances," being closely related to Public Service, is carried in that Division. (See 620. series.)

"Agricultural Products," connected with ranch operations, will be carried in 322. series.

500. **Miscellaneous**
500.1 Burglaries and Thefts
501.
502.
503.
504.
505.
506.
507.
508.
509.
510. **Contracts, Reports, etc.** (Miscellaneous)
511. Property Conveyances and Agreements
512. Abstracts and Certificates of Title
513. Property Damage Reports
514. Inventories

515. Inter-Company Contracts
516.
517.
518.
519.

520. **Non-Utility.** (Miscellaneous)
521. Real Estate (Unimproved)
522. Ranches, Farms, etc.
523. Industrial Enterprises
524.
525. Mining and Oil
526.
527.
528. Irrigation Enterprises
529. General Non-Utility Equipment and Supplies

530.0 **Electric.** (Miscellaneous)
530.1 Franchises
530.2 Water Rights
530.3 Rights of Way (including Crossing Agreements)
530.4 Federal Permits and Easements
530.5 State Permits
531. Hydro Power Plants
532. Steam Power Plants
533. Gas and Oil Engine Power Plants
534. Auxiliary Storage Batteries
535. Transmission Lines
536. Distribution Lines
537. Sub-stations
538. Electric Services, Customers' Installations
539. General Electric Buildings and Equipment

540. **Railway.** (Miscellaneous)
541. Real Estate, Station Buildings
542. Shops and Engine Houses
543. Transfer and Turn-Tables, Cinder-Pits
544. Yards and Terminals
545. Freight Depots and Structures
546. Roadway, Track and Appurtenant Structures
547. Rolling Stock
548. Electric Power Transmission
549. General Railway Buildings and Equipment

560. **Ice.** (Miscellaneous)
561. Real Estate
562. Ice Manufacturing Plants
563. Ice Storage
564. Ice Delivery Equipment
565.
566.
567.
568.
569. General Ice Buildings and Supplies

580. **Water.** (Miscellaneous)
581. Real Estate
582. Pumping Stations, Hydraulic Works
583. Water Supply
584. Pollution and Purification
585. Transmission System
586. Distribution System
587.
588. Water Services, Customers' Installations
589. General Water Buildings and Supplies

590. **General.** (Miscellaneous)
591. Real Estate
592. General Buildings and Structures
593. Machine Shops, Garages and Stables
594. Roads, Bridges, Highway Equipment
595.0 Telephone and Telegraph (Miscellaneous)
595.1 Buildings and Structures
595.2 Telephone Exchanges
595.3
595.4
595.5 Long Distance Lines
595.6 Local Lines
595.7 Local Stations
595.8 Customers' Installations
595.9 General Telephone Equipment and Supplies
596. Vehicles, Accessories and Teams
597. Sidings and Switching Facilities
598. Construction Material and Equipment
599. General Stores and Supplies

600. Public Service —

This Division is intended to carry subjects concerning the relations of the companies to the public and governmental authorities. It includes New Business, Contracts, Rates and Commercial Appliances.

The performance of the service which the company furnishes is, in one sense, an operating matter and belongs to the "Operating" Division; it is, therefore, necessary to bear the distinction in mind that, whereas the "Operating" Division has to do with THINGS, i. e., the companies' physical properties, the Division of "Public Service" has to do with PERSONS, i. e., the companies' dealings with Government officials and consumers, the only exception being that of Commercial Appliances, the purchase, handling and sale of which is placed in this Division by reason of its close relation to the service furnished.

600. **Public Service.** (Miscellaneous)
601. Relations with Government
602. Market Investigations
603. Rates, Rules and Schedules
604.
605.
606.
607.
608.
609.

610. **Contracts, Reports, etc.** (Miscellaneous)
611. New Business Reports and Estimates
612. Appliance Sales Reports and Contracts
613. Electric Contracts
614. Railway Contracts
615.
616. Ice Contracts
617.
618. Water Contracts
619. General Contracts

620. **Commercial Appliances.** (Miscellaneous)
621.
622.
623. Electric Appliances
624.
625.
626. Ice Appliances
627.
628. Water Appliances
629. General Commercial Appliances

630. **Electric.** (Miscellaneous)
631. Domestic Power and Light
632. Government Power and Light
633. Industrial Power and Light
634. Railway Power and Light
635. Mining Oil Power and Light
636.
637. Commercial Power and Light
638. Water and Irrigation Power (including Agricultural)
639. General Electric Service

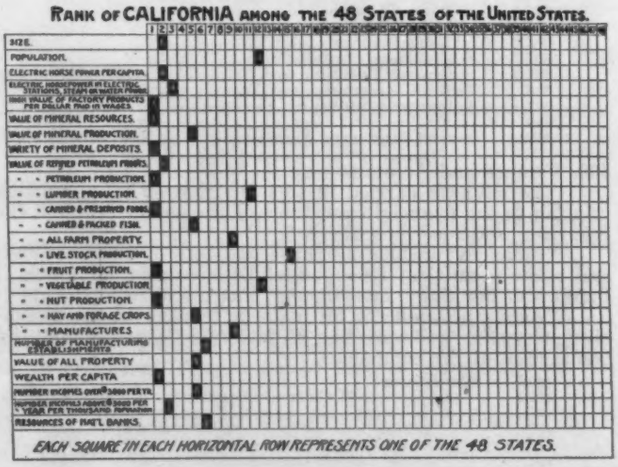
640. **Railway.** (Miscellaneous)
641. Passenger Service
642. Freight Service
643. Express and Baggage Service
644. Mail Service
645.
646.
647.
648.
649. General Railway Service

660. **Ice.** (Miscellaneous)
661. Domestic Ice Service
662. Government Ice Service
663. Industrial Icing and Refrigeration
664. Railway Icing and Refrigeration
665.
666.
667. Commercial Icing and Refrigeration
668.
669. General Ice Service

680. **Water.** (Miscellaneous)
681. Domestic Water Service
682. Government Water Service
683. Industrial Water Service
684. Railway Water Service
685. Mining and Oil Water Service
686.
687. Commercial Water Service
688. Irrigation Service
689. General Water Service

690. **General.** (Miscellaneous)
691.
692.
693.
694.
695. Telephone and Telegraph
696.
697.
698.
699.

RANK OF CALIFORNIA AMONG THE 48 STATES OF THE UNITED STATES.


SIZE.
POPULATION.
ELECTRIC HORSE POWER PER CAPITA.
ELECTRIC HORSEPOWER IN ELECTRIC STATIONS, STEAM OR WATER POWER
HIGH VALUE OF FACTORY PRODUCTS PER DOLLAR PAID IN WAGES.
VALUE OF MINERAL RESOURCES.
VALUE OF MINERAL PRODUCTION.
VARIETY OF MINERAL DEPOSITS.
VALUE OF REFINED PETROLEUM PRODS.
" " PETROLEUM PRODUCTION.
" " LUMBER PRODUCTION.
" " CANNED & PRESERVED FOODS.
" " CANNED & PACKED FISH.
" " ALL FARM PROPERTY.
" " LIVE STOCK PRODUCTION.
" " FRUIT PRODUCTION.
" " VEGETABLE PRODUCTION.
" " NUT PRODUCTION.
" " HAY AND FORAGE CROPS.
" " MANUFACTURES.
NUMBER OF MANUFACTURING ESTABLISHMENTS
VALUE OF ALL PROPERTY.
WEALTH PER CAPITA.
NUMBER INCOMES OVER $3000 PER YR.
NUMBER INCOMES ABOVE $3000 PER YEAR PER THOUSAND POPULATION
RESOURCES OF FNL'L. BANKS.

EACH SQUARE IN EACH HORIZONTAL ROW REPRESENTS ONE OF THE 48 STATES.

MASSACHUSETTS DECISION ON THE ONE-MAN CAR

(In view of the proposed enactment before the California legislature aimed to do away with the one man car, the following comments from the decision of the Public Service Commission of Massachusetts on the use of this type of car by the Bay State Railway Company are of special timely interest. Extended comment on the railway situation will be found on the editorial pages elsewhere in this issue.—The Editor.)

The following extracts from a report of the Massachusetts Public Service Commission in answer to a petition of the Bay State Street Railway Company for the approval of the use of one-man cars over its lines, effectively point out the benefits to the public which may come from the use of such cars and put the justification for their use on other grounds than that of mere economy:

In the "Bay State Rate Case," decided August 31, 1916, the use of one-man cars was strongly urged by the remonstrants against higher fares as a means of giving better service and increasing the net income of the company, and such has also been advocated by operating experts who have examined the property, including Bion J. Arnold, Peter Witt and John A. Beeler. Cars of this type have recently been introduced with success on street railway systems in various parts of the country.

One-man cars have two distinct uses. They may be used merely to decrease expense or they may be used to increase service and business with corresponding increase in cost. On many short lines where traffic is light, frequent service cannot be profitably maintained with ordinary equipment, yet infrequent service means loss of business for people will often walk rather than wait long for a car. By using one-man cars on such routes a 20-minute headway can be changed to a 10-minute headway, or a 30-minute to a 15-minute, with little additional expense and with a gain in service to the public and in traffic to the company.

The objection usually made to one-man cars is that they are dangerous, but recent improvements have robbed this objection of its force. These safety features are operated on much the same principle as the ordinary automatic air brake apparatus, and have no greater delicacy of mechanism. When it is considered that practically all automobiles, including ponderous motor trucks, are one-man operated cars, the comparative safety of electric cars equipped with these devices is evident. It is reported that similar cars in use in other parts of the country have so far proved in actual practice safer, if anything, than the cars operated by two men. This seems to be due chiefly to the fact that all passengers board and alight directly under the eye of the motorman-conductor.

At the hearings the employes of the company opposed the introduction of the new cars, but in the opinion of the Commission this attitude is contrary to their own best interests. The Bay State company has a number of country lines with very low earnings, which are in serious danger of being abandoned unless expense can be decreased, and it also has short-haul lines of the type already mentioned where it ought to be possible to increase both service and patronage by the use of one-man cars, and to meet jitney competition to much better advantage. The company has recognized the principle that a higher rate of wages ought to be paid to the man who combines the functions of motorman and conductor, and if these cars will accomplish the results anticipated, they will improve a situation which is as threatening to the employes as it is to the company itself.

Objections to the operation of one-man cars which are not now foreseen, may develop in practice, and the Commission must, of course, reserve the right to deal without prejudice with any situation which may arise in future. It has no hesitation, however, in expressing its present opinion,—an opinion which is based upon the advice of competent experts in street railway operation and upon knowledge of experience in other parts of the country,—that properly designed one-man cars can be used in many cases with distinct public advantage.

While there may be economy in initial investment in the adaptation of existing cars for one-man operation, this is offset by loss in operating efficiency. The reconstructed car will certainly consume materially more power than the new car, and it is very likely to attract less traffic. While the commission is willing to approve this car for experimental use, it is not willing to approve the reconstruction of additional cars of similar design until evidence is available as to the comparative efficiency of the two types in actual operation.

The company has failed in its petition, however, to give proper recognition to what is, as we have already shown, perhaps the most important advantage of this new type of equipment—namely, the opportunity offered to improve service and attract traffic. On none of the routes specified does the company propose to use the new cars in this way; in each case they are to be used merely as a means of decreasing operating expense.

The management has informed the Commission that it intends to put one-man cars to this use; but this intention ought to be made unmistakably clear to the public, and ought to be carried into practice at the earliest possible moment. If the two cars now in the possession of the company can be used on some short city line to increase a 30-minute to a 15-minute headway, they ought to be put to such use at once, and to facilitate such action the order entered below, approving certain routes for one-man operation, has been so drawn that it may readily be extended from time to time to include additional routes. If, however, a satisfactory application of the theory of increasing service cannot be obtained with two cars only, the company ought to use its best endeavors to secure a sufficient number of cars for this purpose at an early date and in the meantime inform the public fully as to the plans which it intends to carry into effect.

SPARKS—Current Facts, Figures and Fancy

(The successful transmutation of mercury into gold and radium is modestly reported by a Spanish youth. A substitute for platinum reported by the Chemical Division of the War Industries Board promises to be of greater practical value, however. Figures on the jitney bus, a peace time use for flood lighting and various war items are included in this brief survey of things interesting and curious.—The Editor.)

Nearly 7,000 jitney buses are operating in America. Of these 5,800 are competing with street railways in 153 cities; and these 5,800 jitneys have a gross annual income of nearly $14,000,000, or about $2,500 per jitney per annum, the number of employes being 8,200. At the height of "the jitney craze" there were about 20,000 of these buses.

* * *

A recent dispatch from Coblentz would indicate that after-the-war problems in Germany are to be domestic and industrial as well as political. It reads:

"Already in Coblentz there is considerable unemployment, and large numbers of demobilized soldiers are anxious to oust women from the well-paid positions they hold as tramway-car conductors and in other municipal services, as well as in industrial and commercial undertakings. Despite all the efforts of the German authorities to induce the women and girls to go back to household work, little or no progress is being made. The women refuse to resume their pre-war status in the community."

* * *

The longest pipe line in the world extends from the oil fields of Oklahoma and Kansas to the distributing terminus at East Chicago. It is about 800 miles long and one foot in diameter. The engineering difficulties that had to be overcome in the building of this pipe-line were great, notwithstanding the favorable fact that practically the entire line could be laid on flat prairie-land.

* * *

The world's most remote island, so far as getting mail to it is concerned, is unquestionably the Island of Tristan da Cunha, in the middle of the South Atlantic ocean, which is more than a thousand miles from any inhabited land. A woman living there wrote to an English friend in November, 1916. The letter was received in May, 1918. It had been twelve years since they had had a mail delivery on their island.

* * *

During the last one hundred years the average American family has not departed widely from an expenditure of $24 a year for light. The family of today, however, although spending almost the same sum annually for illumination as was spent by the family of a century ago, secures more than twenty times as much light! This astonishing result is credited entirely to American inventors, engineers and business men.

* * *

The danger of cooking with gas fires on railway trains has been shown by the disastrous effects in recent railway accidents in Germany. As a consequence, the Association for Promoting the Utilization of Electricity has taken steps to coordinate the efforts of manufacturers, public bodies, and other interested parties to secure early tests with the object of introducing electric cooking on the German restaurant cars.

Announcement was recently made from Washington that chemists working under the personal direction of Charles H. McDowell, director of the Chemical Division of the War Industries Board, had succeeded in discovering a substitute for platinum in the manufacture of sulphuric acid by the contact process. It is said that the new material is cheaper than platinum and less susceptible of "poisoning." The raw material from which it is derived is alunite.

* * *

The origin of the League of Nations idea has been credited to various statesmen. Leslie's Weekly insists that there is nothing new under the sun—which is old in itself—and the birth of the idea, so far as history shows, dates back to 1023, when Robert II of France, known as The Godly, and Henry II of Germany, known as The Holy, met one August day on the banks of the River Meuse to discuss universal peace in monarchical and kindly manner.

* * *

Although most of the communication on the front was carried out by electricity, there were other methods. The Huns used 50,000 pigeons during the war and the American and British armies employed 30,000 each. Ninety-seven per cent of the pigeons used returned with their messages. Dogs were used not only for purposes of communication but by the medical corps. Even parrots, until they got too bored with their work, were used in Paris on the Eiffel Tower to warn the residents of the approach of Zeppelins and aeroplanes.

* * *

The flood lights which have been making night work possible in the shipyards of the Northwest are to find new applications in peace times. The warden of the Oregon penitentiary is looking forward to securing some of them for guarding the walls of his establishment. He thinks the lights would not only save extra guard hire, but would prevent escapes such as are now possible because of the darkness. He estimates that each escape costs the state an average of $500 in the cost of chasing, capturing and returning the convict.

* * *

The Spanish daily Press recently made mention of an "important discovery." A medical student of Alicante, Don German Botella Perez, has discovered an electrical process by which mercury can be decomposed, leaving a residue of gold and a certain amount of radium. The discover, "a modest youth of 24 years," is very reticent on the subject, and will give no details until he has read a paper before the Alicante Academy of Sciences. In the meantime he is busy selling gold to the jewelers of the city. The inventor's reticence is not surprising.

PERSONALS

Tracy E. Bibbins, president of the Pacific States Electric Company, has been elected president of the Pacific Division of the National Electrical Supply Jobbers' Association. Mr. Bibbins has long been recognized as a helpful factor in the electrical industry throughout the West. Of his many strong characteristics perhaps his willingness and readiness to be always of service in helping to solve problems of the industry and his constant attendance at various meetings devoted to development of the industry as a whole stand out as the most helpful. It is believed that the electrical supply jobbers will prove of constantly increasing helpfulness under Mr. Bibbins' presidency.

R. Q. Cleavenger of the Phoenix Glass Company is planning to spend the month of March on the Pacific Coast.

A. L. Martin, manager of the Marshfield, Ore., division of the Mountain States Power Company, has been elected president of the Marshfield Chamber of Commerce.

E. E. Nash, treasurer of the Peerless Lamp Company of Warren, Ohio, is a recent Pacific Coast visitor and attended the recent Pacific Coast jobbers' gathering at Del Monte.

Henry N. Teague, associate director, division of public works and construction development bureau, Department of Labor, has been in San Francisco recently in connection with his work.

E. E. Berg, who has been with the Hecla Mining Company at Burke, Idaho, for the past year, and with the Washington Water Power Company previous to that time, is now located with the Pacific Power and Light Company at Pasco, Washington.

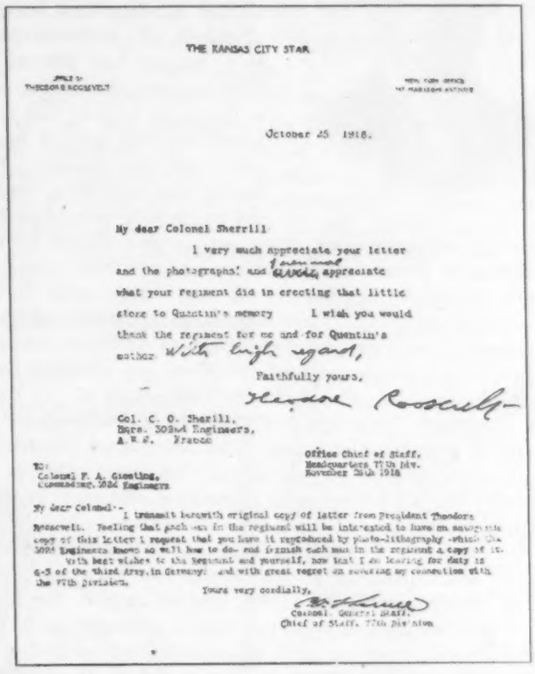
L. R. Jorgensen, a consulting engineer of San Francisco, Cal., and **John B. Fisken,** chief engineer of the Washington Water Power Company of Spokane, Wash., have been nominated for vice-presidents of the American Institute of Electrical Engineers.

Lieutenant-Colonel J. G. Scrugham, formerly dean of mechanical engineering at the University of Nevada, has closed his work in the Ordnance Department at Washington and returned to Reno. He expects to take a well earned rest for a short time before starting any new activities.

K. C. Yih, Vice-Minister of Communications, **Dr. C. C. Wong,** Associate Minister of Communications, and **J. K. Ham,** representing industrial interests, together with several other prominent Chinese, have arrived in San Francisco and are desirous of getting in touch with railroad matters on this coast.

Capt. C. E. Grunsky, Jr., familiar to readers of the Journal of Electricity as the author of one or two of the valuation articles in the series furnished by his father, C. E. Grunsky, Sr., and more recently captain with the 115th Engineers in France, has been given a special commission in charge of the Mining Department in the Finance and Economics Section of the Engineer Department of the American Peace Commission. His work includes the valuation of all the intangible losses at the mines due to the war.

Colonel Frank A. Giesting, a graduate of the University of California with the class of 1906, who prior to the outbreak of the war was on the engineering staff of the Knoxville Power Company with headquarters at Alcoa, Tenn., was in command of the 302nd Engineers in France when the grave of Quentin Roosevelt was discovered. Theodore Roosevelt, his father, appreciatingly acknowledged this service in an interesting letter, a facsimile of which is given below:



THE KANSAS CITY STAR

THEODORE ROOSEVELT

October 25 1918.

My dear Colonel Sherrill

I very much appreciate your letter and the photographs and I also appreciate what your regiment did in erecting that little stone to Quentin's memory I wish you would thank the regiment for me and for Quentin's mother With high regard,

Faithfully yours,

Theodore Roosevelt

Col. C. O. Sherill,
Comd. 302nd Engineers,
A.E.F. France

To:
Colonel F. A. Giesting,
Commanding, 302d Engineers

Office Chief of Staff,
Headquarters 77th Div.
November 26th 1918

My dear Colonel:-

I transmit herewith original copy of letter from President Theodore Roosevelt. Feeling that each man in the regiment will be interested to have an exact copy of this letter I request that you have it reproduced by photo-lithography -which the 302nd Engineers knows as well how to do- and furnish each man in the regiment a copy of it.

With best wishes to the regiment and yourself, now that I am leaving for duty as G-3 of the Third Army, in Germany; and with great regret on severing my connection with the 77th Division.

Yours very cordially,

Colonel, General Staff,
Chief of Staff, 77th Division

A. J. McConnell, president of the Cordova Power Company, Cordova, Alaska, was in Seattle some days ago en route to New York.

W. R. Putnam, formerly sales manager of the Utah Power & Light Company, has been promoted to the position of assistant general manager. **H. M. Ferguson,** formerly with the Missoula Light & Power Company of Missoula, Montana, succeeds Mr. Putnam in his former activities.

H. H. Jones, general manager of the San Diego Consolidated Gas & Electric Company, is back again at his desk in San Diego after undergoing an operation at the hospital. Mr. Jones is general chairman of the convention committee for the Coronado convention of the Pacific Coast Section, N. E. L. A., and from rumors that persist in coming up from the southern district of the state he is planning to eclipse all previous records.

Henry Bostwick, manager of the San Francisco district of the Pacific Gas & Electric Company, has been elected president of the San Francisco Electrical Development League. Mr. Bostwick has in recent months been an active factor in much of the helpful war work undertaken by the Rotary Club of San Francisco. His work among the wounded soldiers at the Letterman Hospital has proven especially effective. Much is in store for the San Francisco League in coming months due to the splendid shape in which its affairs stand today and the plans ahead which Mr. Bostwick is already formulating.

H. H. Bliss, in charge of technical instruction for the Extension Division of the University of California, has just completed a helpful course for study by correspondence designed to be of assistance to any one engaged in the electrical industry who desires to get a clearer grasp of the fnudamental laws of electricity. In previous years this course has proved of wide interest, something like a thousand men of the electrical industry having registered for the course. The course has now been rewritten to embody new ideas and features of instruction not attempted in this course before. It particularly flavors of illustration and practical problems met with in the West where electricity is used to a degree not elsewhere attained. This helpful work is receiving encouragement from many quarters. Central station managers, manufacturers, jobbers, contractor-dealers, are advising their employes to take it. The Advisory Committee of the California Electrical Campaign has declared its willingness to be of every possible assistance. The Journal of Electricity is devoting its columns to help spread the news. This is an opportunity for all believers in increasing efficiency by further study to say a good word for this course.

Dr. Frederick G. Cottrell, a graduate and former professor of the University of California, has been presented with the Perkin medal, one of the highest awards for work in the field of applied chemistry, which is annually conferred by the affiliated chemical and electro-chemical societies of America. The award of the Perkin medal to Dr. Cottrell was made in recognition of his pioneer work in the field of electrical precipitation. The process which Dr. Cottrell invented and first put into operation at the plant of the Hercules Powder Company at Pinole, California, is responsible for saving many millions of dollars' worth of smelter and mine products, which would otherwise have been lost.

Calvin A. Rice, secretary of the American Society of Mechanical Engineers with headquarters in New York City, will make a visit to all important western engineering centers during March and April. With the return of normal conditions in industry comes the opportunity to resume the interest and work in the national engineering societies and men of the West will welcome his helpful presence among us. His itinerary as tentatively planned is as follows: Houston, Tex., March 5, Los Angeles, Cal., March 11-14, San Francisco, Cal., March 16-22, Portland, Ore., March 25, Seattle, Wash., March 27, Spokane, Wash., March 31, Butte, Mont., April 3, Salt Lake City, Utah, April 7, Denver, Colo., April 10, and Omaha, Neb., April 14.

OBITUARY

E. H. Jacobs, construction engineer and superintendent of all distribution lines of the Western States Gas & Electric Company at Stockton, California, died of pneumonia on January 16th, after having been ill with influenza for about ten days. Mr. Jacobs had been connected with the Western States Company for ten years, and for the last seven years had been located at Stockton.

Major C. S. Noble, Spanish-American war veteran and for several years engineer for the Oregon state highway commission, died of pneumonia at Tours, France, according to a cable message recently received. Major Noble was engineer for Oregon City for a number of years. Then, practically at the time of the formation of the state highway commission, he was offered a position as an engineer with that body. He continued in this capacity until last fall, when he resigned in order to go to France for the Y. M. C. A. as consulting engineer.

The electrical fraternity has suffered a deep bereavement in the passing of W. L. McKinley. A man of genial personality and kindly ways, Mr. McKinley made a host of friends throughout the state who will feel keenly his loss. His whole life was given to the electrical industry and for the past twenty-five years he has been identified with this work on the Pacific Coast, where, in the early days, he was one of the pioneers in the installation and construction of electrical distribution systems. "Bill" McKinley, as he was intimately known by his many friends, was born about twenty miles southeast of LaGrange, Troop county, Georgia. His early education was received at a little log cabin school in the neighborhood and he later graduated from the grammar and high schools of Chattanooga, Tennessee. In 1889 he entered the employ of the old Thompson-Houston works prior to its consolidation with the Edison Company, from which position he went two years later to assist in the construction of the electric street railway system in St. Louis, and in the construction of the municipal street lighting system in the same city. He was also identified with the World's Fair at Chicago, where he was responsible for some of the fine electrical effects which were developed at that exposition. He first came to the Pacific Coast in 1894 to assist in the electrical features of the Mid-Winter Fair in San Francisco. It was here that he became associated with Jerry Dunn, and after the Fair formed a partnership with Messrs. Dunn and Peterson to engage in the business of electrical contracting. Their first work was the installation for the Pacific Power Company of the first underground electric system in San Francisco. In 1895 they installed the first electric transmission and distribution system in the mining district in the vicinity of Nevada City and Grass Valley, where they built the power line from the Yuba Power House to Nevada City, and constructed the distribution system in these towns for the Nevada County Power Company, the nucleus of the great system of the Pacific Gas & Electric Company. In 1896-97 Mr. McKinley built the system in Vallejo to distribute electric energy from one of the first steam plants installed by Chas. C. Moore and Company. In 1897 he went to Tuolumne county and built the electric distribution system among the mines there for the Tuolumne County Electric Light and Power Company. He was general manager for that company for ten years until it was purchased by the Sierra and San Francisco Power Company, since which time he was continuously associated with Capt. H. F. Jackson in the management and operation of this property up to the time of his death in his home in San Francisco, on February 19th, 1919. His loss will be keenly felt by the Sierra and San Francisco Power Company. Mr. McKinley leaves two children—Walter, who is a wireless operator on the U. S. S. Martha Washington, and Eunice, his charming daughter with whom many electrical men have become acquainted through her attendance at the convention of the National Electric Light Association at Del Monte last year.

MEETING NOTICES FOR ELECTRICAL MEN

(Enthusiasm for the Coronado N. E. L. A. convention is growing with the coming of the spring weather. There have been many local meetings of great interest in the last two weeks period, with special activity reported from the Northwest. Arc welding proves a timely topic at Section meetings throughout the West.—The Editor.)

Joint Meeting — Spokane

The regular meeting of the Spokane Section, A. I. E. E., was held on February 21, 1919, at the Chamber of Commerce Assembly Room as a joint session with the A. S. M. E., A. S. C. E. and the Spokane Engineering & Technical Association.

Dr. C. E. Magnusson, Professor of Electrical Engineering at the University of Washington, presented "A Plan for the Development of Our National Electric Power Resources," the details of which are to be found in the issue of the Journal of Electricity for Nov. 15, 1918. In brief, the plan proposes the application of the principle of the Reclamation Service to electric power development, the government to build main power lines from which the current is bought at wholesale by private companies. The plan brought out most interesting discussion. It was pointed out that government ownership was at present unnecessary, more expensive and less effective. The plan, it was claimed, was ahead of the times because private companies are successfully interconnecting wherever conditions warrant. The leaders in the discussion were J. B. Fisken, Professor Magnusson, Ludwig Kemper and G. E. Quinan, and John Harisberger of Seattle. Paul Lincoln was announced as the speaker for the next meeting. The attendance was about fifty.

Oregon Society of Engineers

The Oregon Society of Engineers at a recent meeting elected officers for the coming year, as follows: J. W. Cunningham, president, O. Laurenguard, vice-president, O. E. Stanley, secretary, H. M. Morris, treasurer; P. H. Dater, A. A. Kratz and H. Munn, directors.

Denver Section, A. I. E. E.

Electric welding was discussed by the Denver section, A. I. E. E., at the Feb. 15th meeting. G. N. Robinson of the General Electric Company surveyed the present situation. As he showed, the efficacy with which this art has been used in shipbuilding and other war industries indicates that its use will be greatly extended in industry in peace times. Various lantern slides showed the applications of the art.

Los Angeles Jovian Electric League

The Wednesday meeting of the Los Angeles Jovian Electric League of Feb. 19, 1919, was held at Hotel Clark, which is to be the regular meeting place from now on. "Teddy" Tetzlaff was the feature of the occasion, speaking on the "Thrills and Spills in the Racing Game." Senator Geo. W. Cartwright spoke on the "Labor Situation" and offered constructive suggestions as to the handling of the present trend toward Bolshevism.

Of course, there was varied entertainment on the side.

Seattle Section, A. I. E. E.

"The present day uses of the X-ray" was the subject of the Feb. 18th meeting of the Seattle Section, A. I. E. E. C. R. Wallis of the General Electric Company was the speaker of the occasion and pointed out the use of the X-ray in the detection of flaws in construction materials, such as castings, built up mica insulation, etc., as well as the many surgical uses. The talk was well illustrated with lantern slides.

BUILDERS OF THE WEST—XLVIII

FREDERICK G. COTTRELL

To Dr. Frederick G. Cottrell, chief metallurgist of the U. S. Bureau of Mines, inventor of the famous Cottrell electrical system of handling obnoxious particles in chimney gases, and more recently inventor of a new method of producing helium and oxygen that will revolutionize certain industrial activities of the nation, this issue of the Journal of Electricity is affectionately dedicated. The splendid type of broad building exhibited by Dr. Cottrell as a product of our great West is indeed a source of inspiration and enthusiasm to all beholders.

American Welding Society Endorsed

A new organization of those interested in welding has been formed under the title of the American Welding Society. The objects of the society are given as follows:

A—To advance the science and art of welding.

B—To afford its members opportunities for the interchange of ideas with respect to the science and art of welding, and for the publication of information thereon.

C—To conduct research into the science and art of welding, cooperating with other societies, associations and government departments for the benefit of the industry in general.

D—To acquire and dispose of property for the purposes aforesaid. (This clause to be dependent upon its legal aspect.)

E—To do all other things incidental or conducive to the attainment of the above named objects, or any of them.

The membership of the society is to be made up of individuals, organizations or government departments who are interested in the problems of welding. Among those asked to send representatives to the meeting for the purpose of organization were the U. S. Shipping Board, A. S. M. E., A. S. C. E., A. I. E. E., Bureau of Standards, the War and Navy Departments and many others.

At a meeting of the San Francisco Section, A. S. M. E., which was devoted to the subject of Electric Arc Welding, the following telegram of encouragement was sent with the unanimous endorsement of the meeting:

Mr. Comfort A. Adams,
12 Farrar St.,
Cambridge, Mass.

At a meeting of the San Francisco Section of American Society Mechanical Engineers held at the Engineers' Club San Francisco February thirteenth to discuss the subject of Electric Arc Welding it was unanimously

Resolved, That it be the sense of this meeting that its chairman be requested to send a telegram of greeting to Prof. Comfort A. Adams expressing the interest of engineers of this district in matters pertaining to welding and that Prof. Adams be requested to convey the felicitations of this meeting to the officers and members of the newly organized American Welding Society.

E. C. JONES.

San Francisco Electrical Development League

John D. Galloway was the speaker of the day at the Feb. 17th luncheon of the San Francisco Electrical Develop-

ment League and gave a most interesting account of the share taken by some of the western engineers in the war.

The Feb. 24th meeting was a joint meeting between the league and the Business and Professional Women's Club of San Francisco. Miss Lillian Palmer spoke on what the Business Women's Club can do for the electrical industry, Mrs. Lillian Sherwood told of how to make the most of the office force, and Miss Mae B. Wilkins encouraged the further development of California's resources.

The Pacific Division, Electrical Supply Jobbers

The recent meeting of the Electrical Supply Jobbers' Association at Del Monte, Feb. 13, 14 and 15, will go down in the records as one of the most successful in history. The Saturday meeting, devoted to a discussion of problems confronting the industry as a whole, was unusually helpful. The meeting was opened under the auspices of the manufacturers, with R. M. Alvord of the General Electric Company in the chair. W. M. Deming, general manager of the Technical Publishing Company, publishers of the Journal of Electricity, gave a comprehensive survey of the present status in the electric trade. Numerous telegrams and letters were read from large and small manufacturers which gave very interesting and instructive data on the great problems of the hour. The data will be published in full in the Salesman's Issue of the Journal of Electricity which will appear March 15, 1919. The keynote sounded throughout in these remarkable letters is that the United States is today in position to enjoy the greatest era of prosperity in its history and that pessimism is today as dangerous as the pacifists' utterances during the war period.

R. M. Alvord, in the absence of A. E. Wishon, assistant general manager of the San Joaquin Light & Power Corporation, who was to have delivered a paper, then brought out the salient features of the present work of the California Electrical Cooperative Campaign. Tersely put they are these:

1. That we as members of the industry should consider our vocation worthy to serve society.

2. Exchange of service, goods and ideas is ethical, provided all parties are bettered, including the public and the consumer.

3. To improve ourselves, increase efficiency and serve better.

Garnett Young, president of Garnett Young & Company, presented an interesting paper entitled "The Pacific Coast a Market for Pacific Coast People."

In the discussion which followed these papers A. M. Irwin, of the Westinghouse Electric & Manufacturing Company, emphasized the necessity of reduction in costs of accounting and the advisability of getting the electrical trade on a cash basis.

W. S. Berry, sales manager of the Western Electric Company, pointed out the probable status of the trade in the years ahead would follow somewhat the period after the Civil War, from 1865 to 1880, in which prices declined somewhat, yet labor remained high and still the country at large was very prosperous.

C. C. Hillis, general manager of the Electric Appliance Company, called attention to increased rates in deliveries, amounting to eight per cent, due to the parcel post system and the consequent ban that should be put on the small order business.

L. H. Newbert, chairman of the advisory committee of the California Electrical Cooperative Campaign, emphasized the necessity for the development of the contractor-dealer in order that he may come to a fuller realization of the vast possibilities of the contractor-dealer movement.

Those present at the meeting were as follows:

Alvord, R. M., General Electric Company, San Francisco
Airey, F. J., Pacific States Electric Company, Los Angeles
Anderson, S. B., Pacific States Electric Company, San Francisco
Beck, F. G., National Carbon Company, San Francisco
Behan, R. F., John A. Roebling's Sons Company, San Francisco
Berry, W. S., Western Electric Company, San Francisco
Bibbins, T. E., Pacific States Electric Company, San Francisco
Boring, G. A., Pacific States Electric Company, Portland
Booth, P. M., Edison Electric Appliance Company, Ontario
Butts, D. J., Western Electric Company, San Francisco
Case, J. O., General Electric Company, Los Angeles
Colwell, J. I., Western Electric Company, Seattle
Davis, R. J., Century Electric Company, San Francisco
Deming, W. M. (and wife), Journal of Electricity, San Francisco
Elliot, A. H., Sec'y Electrical Supply Jobbers' Ass'n, San Francisco
England, H. I., Gilson Electrical Supply Company, Oakland
Fagan, F. D. (and wife), Edison Lamp Company, San Francisco
Francis, Ira (and wife), John A. Roebling's Sons Company, San Francisco
Gifford, C. M., H. W. McCandless & Company, San Francisco
Gregory, S. B., Arrow Electric Company, San Francisco
Gray, G. A., Manufacturer's Agent, San Francisco
Gerhardt, F. A., Crouse-Hinds Company, San Francisco
Green, W. H., Chicago Fuse Manufacturing Company, San Francisco
Holabird, R. D., Holabird Electric Company, San Francisco
Holabird, H. G., Holabird Electric Company, Los Angeles
Holterman, R. J., Holabird Electric Company, San Francisco
Heise, Carl (and wife), Westinghouse Electric & Mfg. Co., San Francisco
Hall, C. B., Illinois Electric Company, Los Angeles
Harper, H. L., Western Electric Company, Los Angeles
Harris, D. E., Pacific States Electric Company, San Francisco
Hillis, C. C., Electric Appliance Company, San Francisco
Hawley, C. B., Intermountain Electric Company, Salt Lake City
Harris, M. M., Baker-Pacific Hardware & Steel, San Francisco
Holberton, G. C., formerly Pacific Gas & Electric Co., San Francisco
Irwin, A. M. (and wife), Westinghouse Electric & Mfg. Co., Los Angeles
Merrill, W. W., Chicago Fuse Manufacturing Company, Chicago.
Murphy, F. S., guest of C. B. Hawley
Noack, Harry, Pacific States Electric Company, San Francisco
Nash, E. E., Peerless Lamp Company, Warren, Ohio
Oman, G. L., Pacific States Electric Company, Portland
Oakes, R. F., National Carbon Company, San Francisco
Quick, Paul, Landers, Frary & Clark, San Francisco
Pomeroy, J. G., Manufacturer's Agent, Los Angeles
Painter, J. V., Appleton Electric Company, Chicago
Petersen, S. W., Stubbs Electric Company, Portland
Sweet, Leon (guest of C. B. Hawley), Salt Lake City
Sanderson, H. E., Bryant Electric Company, San Francisco
Sawyer, W. B., Jr., United States Steel Products Company, San Francisco
Shreve, E. O., General Electric Company, San Francisco
Sibley, Robert, Journal of Electricity, San Francisco
Steele, M. F., Benjamin Electric Manufacturing Company, San Francisco
Taylor, S. H., Electric Ry. Mfg. & Supply Company, San Francisco
Vandegrift, J. A., National Lamp Works, Oakland
Wallis, E. J. (and wife and friends), Western Electric Company, S. F.
Wiggin, C. E., Dunham, Carrigan & Hayden, San Francisco
Ward, S. G., Western Electric Company, Portland
Will, C. M., Fobes Supply Company, Portland
Young, Garnett (and wife), Garnett Young & Company, San Francisco
Yost, H. F., Trumbull Electric Mfg. Company, San Francisco

The golfing tournament followed by the banquet had unusual thrills. The manufacturer's cup was won by W. B. Sawyer of the United States Steel Products Company while C. B. Hawley of the Intermountain Electric Company of Salt Lake City carried away the famous jobber's cup—the copper trophy now such a splendid tradition in this organization. Harry Holabird of the Holabird Electrical Company, Los Angeles, acted as toastmaster, and in his quiet way succeeded in inducing Ira Francis, H. E. Sanderson, Albert Elliot, C. C. Hillis, and C. B. Hawley to establish new records in the art of oratory that will long linger in the minds of those present. And then there was the singing by Bill Shreve and Frank Fagan, to say nothing of the world record in automobile traffic from San Francisco to Del Monte established by the latter gentleman—all incidents that gave spice and entertainment to this gathering.

British Columbia Electrical Contractors and Dealers

The British Columbia Association of Electrical Contractors and Dealers will hold their convention in the latter part of May, at Vancouver, B. C. Special interest is being taken in the plans for the meetings as Mr. Samuel Chase, of the Westinghouse Company, Pittsburgh, Pa., has already promised to be present. It is also probable that W. L. Goodwin will be here to discuss his plans for national benefit. An effort will be made to notify every electrical man in the province, even up to the Yukon.

Midwinter Convention of A. I. E. E.

The seventh midwinter convention of the A. I. E. E. took place in New York on Feb. 19-21. Among the topics of interest discussed in the technical sessions were those of Electric Welding, Radio Telephony, New Astronomy and other subjects of present day interest. Excursions were made to the Brooklyn Navy Yard and the Bell System Laboratories of the Western Electric Company.

A view of the attractive Coronado Hotel which is to be the scene of the big Victory Convention of the Pacific Coast Section N. E. L. A. on Apr. 30th-May 2d. Plans are already being made for automobile parties from San Francisco and intermediate points, as well as the delegation who are to go down on the train. It is expected that the many eastern visitors will later take in the points of interest about the state.

THE BIG VICTORY CONVENTIONS AT CORONADO

The Coronado convention plans are fast rounding into shape. Men from all quarters of the West and many in eastern centers are planning to make the last week in April and the first week in May a period for interchange of ideas and for getting some comprehension of the vast new business opportunities of the West. To this end the great hotels such as the Coronado and the Del Monte are making forecasts for unusual visits during this period of the year, when California is at her best.

April 30th-May 2d, inclusive, are the dates for the third annual convention of the Pacific Coast Section, National Electric Light Association.

Hotel del Coronado, Coronado Beach, California, is the meeting place. The hotel rate will be $5.50 per day for room and bath. All meetings will be held in the hotel, which is admirably suited for this purpose.

A large attendance is already assured, not only because of the intense interest of members in the papers and discussion to be presented at this Victory Convention, but also because of the fact that the quarterly meeting of the California Association of Electrical Contractors and Dealers and the Pacific Coast Electrical Supply Jobbers' Association are to be held at the same time and place. The Westinghouse Agent Jobbers' Association will also schedule a special train from Chicago so that its members may attend this meeting prior to their own annual gathering, at Del Monte, May 4-11. This means an additional attendance of 60 or 70 jobbers from all parts of the country.

Papers —

All papers will be printed in the Journal of Electricity of April 15, 1919, a copy of which will be mailed to members in ample time to prepare discussion. No papers will be read at the meeting, so as to allow full opportunity for discussion.

Commercial Committee Program —

A. W. Childs, chairman of the Commercial Committee, has announced a preliminary list of papers subject to possible change. These include the following:

"The Proper Training of the Sales Personnel," by Lee H. Newbert, I. W. Alexander and J. F. Pollard.
"The Contractor-Dealers of Tomorrow," by John C. Rendler.
"The Jobbers' Relation to the Industry," by W. S. Berry.
"Means for Establishing Closer Relations Between the Architects and the Electrical Industry," by J. O. Case.
"Interesting the Consumer," by T. W. Simpson.
"Progress of Electric Cooking and Heating," by B. M. Maddox.
"Wiring for Heavy Wattage Appliances," by author to be announced later.

Engineering Committee Program —

H. A. Barre, chairman of the Engineering Committee, has arranged for the following papers, to which others will be added subsequently:

"Protective Relays on Main Transmission Lines," by Geo. E. Armstrong.
"Some Minor Aspects of Interconnected Systems," by L. M. Klauber.
"The San Joaquin-Edison Interconnection," by G. R. Kenny.
"Development of Small Automatic Power Plants," by E. A. Quinn.

Convention Committee —

H. H. Jones, manager of the San Diego Consolidated Gas & Electric Company, will act as chairman of the general convention committee, and Mr. William Clayton, of the United Light, Fuel & Power Company of San Diego, will be vice-chairman. This committee has charge of all convention arrangements and is made up of the chairmen of the various sub-committees, each of whom will appoint his own committee to handle the work.

Chairman Jones has announced the personnel of his sub-committee chairmen as follows:

Papers—J. B. Black, Great Western Power Company, San Francisco.
Registration and Hotel—A. E. Holloway, San Diego Consolidated Gas & Electric Company.
Transportation—W. M. Deming, Journal of Electricity.
Reception—William Clayton, United Light, Fuel & Power Company, San Diego.
Entertainment—K. E. Van Kuran, Westinghouse Electric & Manufacturing Company.
Publicity, Printing and Meeting—A. H. Halloran, Journal of Electricity.
Outdoor Sports—G. H. P. Dellman, General Electric Company.
Banquet—T. E. Bibbins, Pacific States Electric Company.
Ladies' Entertainment—W. L. Frost, Southern California Edison Company.
Finance—J. F. Pollard, Sierra & San Francisco Power Company.
Auditing—B. B. Stith, Western States Gas & Electric Company.

Transportation and Hotel Committees —

W. M. Deming, master of transportation, in conjunction with A. E. Holloway, chairman of the Hotel and Registration Committee, will soon send out a circular giving rates and accommodations schedule. The Pacific Steamship Company's "S. S. President" will leave San Francisco, 12 noon, April 28, arrive at Los Angeles, 12 noon, April 29, whence the Santa Fe may be taken to San Diego, arriving there at 6:10 p.m., April 29th, or the steamer may be taken so as to reach there at 4:30 p.m., April 30th. The steamer leaves San Diego, 11 p.m., Sunday, May 4th, and reaches San Francisco Tuesday noon. There is also a possibility that Mr. Deming will prevail upon the Federal Railroad Administration to put special convention rates in effect on the railroads. Many members are planning to drive their automobiles to San Diego.

N. E. L. A. Exhibition Committee Plans for 1919

The Exhibition Committee of the N. E. L. A. held a meeting at the Headquarters on February 15th, under the chairmanship of Mr. J. W. Perry. It was formally decided to approve the proposition to hold the next annual convention at Atlantic City the week of May 19th, and to resume all the proposed plans and activities that had been so carefully worked out in 1917, with additional features of interest to the operating member companies. These will be given in full for publication as soon as possible. In the meantime the exhibition committee is now communicating with all the pledged and prospective exhibitors, upon whom it is impressing the fact that this is the Reconstruction Convention after the Great War, the most notable and historic in the life of the N. E. L. A. Mr. H. G. McConnaughy, secretary of the Exhibition Committee, can be addressed on all such matters at the Association offices, and it is suggested that all exhibitors get in touch with him at once.

Meeting of Portland Electrical Contractors

The regular meeting of the Portland District Association of Electrical Contractors and Dealers was held at the American Cafeteria on Monday evening, Jan. 27, 1919.

Communications from the National Association, B. W. Paul, Massachusetts State Association, Beaver Electric Co. and Pennsylvania State Association, were read, ordered answered and filed, except the letter from Pennsylvania State Association, which was referred to the legislative committee.

Mr. Green, of the legislative committee, reported that the licensing bill would be introduced in the lower house in a revised form, the committee having deemed it advisable to change same by including therein a provision incorporating the adoption of the Electric Code prepared by the U. S. Bureau of Standards, wherever there was no existing state and municipal ordinance.

The wiring committee, having no report, was asked by the chairman to have a report ready by the next meeting.

Mr. Knight, of the finance committee, reported progress and promised to have a report and recommendations at the next meeting.

Mr. Scott reported having added some new price sheets to the retail price book and that some changes were now in the hands of the printer.

Considerable discussion was had in regard to installing of fire alarm bells and Mr. Jaggar reported that the fire marshal had made a ruling that he would only pass jobs for this work having six-inch bells, break glass boxes, snap lock switches for testing and wire of sufficient strength to make said installation a good job. Upon motion the matter was referred to a committee consisting of S. C. Jaggar, F. C. Green and R. W. Larsen.

Mr. Larsen reported that he had attended the meeting of the Pacific Division at Sacramento, Cal., on January 10 and 11 and what matters were discussed and recommendations made, also of visiting San Francisco and what he noticed among the contractors of California.

There being no further business the meeting adjourned at 9:30 p.m.

HAPPENINGS IN THE INDUSTRY

NEW POWER DEVELOPMENT

A deal has been closed with an Eastern syndicate for underwriting $7,500,000 of securities of the Great Western Power Company of California, a new corporation, which will take over the properties of the Great Western Power Co. The new securities consist of $6,000,000 first and refunding 6 per cent bonds of the new Great Western Power Company of California and $1,500,000 of 7 per cent cumulative preferred stock of the same corporation. The purpose of the initial issue is to build a new power plant on the Feather river at Caribou, a point on the old Caribou trail in that region about nine miles up river from Belden. It will also furnish sufficient money for the construction of a new power transmission line to San Francisco bay of 150,000 volts.

The new plant, which is the first one of any size to be built in California for a number of years, will be one of the largest in the United States, having a capacity of 120,000 kilowatts in continuous output. Present plans provide for the development of one-third of this potential capacity, or 40,000 kilowatts. The transmission line will be 192 miles in length.

INCOME TAX DUE

Work on the collection of $6,000,000,000 has been begun by the Bureau of Internal Revenue. This is the estimated yield of the new revenue bill. The income tax provisions of the act reach the pocket-book of every single person in the United States whose net income for 1918 was $1000 or more, and of every married person whose net income was $2,000 or more. Persons whose net income equaled or exceeded these amounts, according to their marital status, must file a return of income with the collector of internal revenue for the district in which they live on or before March 15. The normal rate of tax under the new act is 6 per cent of the first $4,000 of net income above the exemptions, and 12 per cent of the net income in excess of $4,000. Incomes in excess of $5,000 are subject also to a surtax ranging from 1 per cent of the amount of the net income between $5,000 and $6,000 to 65 per cent of the net income above $1,000,000.

COURSE FOR COMPANY EMPLOYES

Business men of industrial concerns in the San Francisco Bay region may organize through the University of California Extension, special courses to meet the peculiar needs of their employes. Any concern having fifteen or twenty men in need of special training may apply by mail to Professor Richardson at 301 California Hall, Berkeley, for the organization of a special class limited to the employes of that concern. Courses available cover a wide range of subjects, including special instruction in Spanish, Russian, trade conditions, banking relations, etc., for employes of commercial houses; construction in automobile care and repair; civil engineering, electrical engineering, shop work, business English, shorthand and typewriting, accounting, and numerous other allied subjects. Application for these special courses may also be made at the San Francisco Chamber of Commerce.

PROPOSED CHANGE IN CALIFORNIA STATE INSURANCE

The California Industrial Accident Commission is opposing the passage of Senate Bill No. 603 and Assembly Bill No. 791. These bills propose to take the State Compensation Insurance Fund from the management of the Commission and place it under the jurisdiction of other state officials.

There are excellent reasons why the Industrial Accident Commission should continue to direct the State Compensation Insurance Fund. Ever since January 1, 1914, the fund has been under the actual management of expert insurance men, selected for their positions because of their ability. The outcome is a well-managed fund, recognized as the most successful institution of its kind in the United States.

More than $790,000 has been returned in dividends to policy holders, thus affording a striking example of mutual

insurance under state auspices. The overhead expenses of the fund are less than 13 per cent of premiums, as against 40 per cent for stock companies. The net surplus on January 1, 1919, was over $1,000,000. Over $2,000,000 of assets is invested in United States Liberty Bonds and California municipal bonds, drawing interest for the benefit of the policy holders. California's employers have been saved an average of over 34 per cent of compensation insurance cost for the years 1914 and 1915 (for which the reserve period has expired), and an initial refund averaging 15 per cent is returned to policy holders at the end of each year.

POLISH COMMERCIAL BUREAU

A Commercial and Industrial Bureau of the Polish National Department has been formed, with the object to help in starting commercial relations between the United States and Poland, and to collect all data and information which should form a basis for the work of the future official Polish commercial agencies in this country, and facilitate mutual economic relations.

THE PROGRAM OF POWER DEVELOPMENT

A Letter to the Editor

(What is being done and what should be done in the matter of pushing power development in the West is here pointed out in a letter from Major Sever of the War Industries Board, who thanks the Journal of Electricity for its services in furthering this great end.—The Editor.)

Editor, Journal of Electricity:

I certainly appreciate your efforts to further the hydroelectric development on the Coast and also your viewpoint as to the desirability of these developments for meeting the industrial growth of the Coast and also to replace the use of fuel oil and thus carry out the idea of conservation of natural resources. The assistance which you gave me in many ways is deeply appreciated and I trust the joint efforts of all will result in securing a largely increased electric power supply for California. Imagine, if you will, what will happen to California when it is not able to secure power from oil or expensive coal and does not have sufficient hydroelectric capacity to meet all the industrial needs of the state. California has to depend absolutely upon the further development of hydroelectric power and at a rapidly accelerated rate, for judging from the most reliable reports the oil supply is not going to be of long duration and nothing else will replace it economically except the extensive development on the correct basis of hydroelectric energy. The latter will last for all time, judging from past meteorological records. This thought should be set forth over and over again in order that some action can be secured. It is hoped by some that the Conference Committee on the Administration Water Power Bill will take some action during this Congress and some result will be secured. I sincerely hope that something will develop in order to remove this doubt from the minds of those who desire to carry out the hydroelectric projects that are necessary for the life of California.

Incidentally, the companies of California have a program up and down the state which calls for an expenditure during the next five years of over $80,000,000.

Anything you can do, and I am sure you will do everything, to push this matter along, will undoubtedly be appreciated by the inhabitants of California.

GEO. F. SEVER.

TRADE NOTES

Reorganization of Company —

The Pulverized Fuel Equipment Corporation has recently been organized for the purpose of taking over the business of the Locomotive Pulverized Fuel Company, and to broaden the activities of the latter to cover the central power station, metallurgical and industrial fields. The head offices are at 30 Church street, New York City, with Canadian office in the Transportation Building, Montreal. This corporation installs and delivers in operation complete plants of its "Lopulco" system for the preparation, distribution, storage, feeding and burning of pulverized fuel for steam generating or heating purposes.

Fixation of Nitrogen —

The American Nitrogen Products Company, Ltd., is constructing a battery of furnaces for the fixation of nitrogen from the air, by the use of surplus power from the system of the British Columbia Electric Company. The furnaces will be located near the Lake Buntzen No. 1 Plant, and will be supplied from this source.

Change of Location —

Announcement is made of the removal of the New York sales office of the Edison Storage Battery Company from 209 West 76th street, to 247-251 West 35th street, New York City.

New Address —

After January 1, 1919, the address of the executive offices of the Associated Advertising Clubs of the World was changed to 110 W. 40th street, New York City.

New York Office —

The Square D Company, Detroit, manufacturers of Square D Switches, opened a new metropolitan office at 149 Broadway, New York, on Jan. 1. J. A. Jaques, district sales manager, has been placed in charge of the office.

Chicago Appointment —

The Roller-Smith Company, 233 Broadway, New York City, announces the appointment of Mr. Frank H. Ryan to the sales force of its Chicago office located at 740 Monadnock Block.

Enlarged Scope —

A. L. Myers & Company of San Francisco is planning to materially enlarge the scope of its business activities. Mr. Wm. M. Schwartz, who has just been mustered out after a year or more in government service, will in future be associated with Mr. Myers. Larger quarters are being secured in order to provide suitable facilities for the enlarged business.

Electric Furnace in Use —

The Ludthorpe Electric Metals Co., Ltd., is constructing a plant and establishing a 1500 kw. 3-phase furnace in Vancouver, B. C. The firm has arranged to secure all the cast-off metals of the C. P. R. shops, and will also work on an accumulation of metal borings and similar scrap that can be successfully handled by such modern methods.

Company Meeting —

The second annual convention of Oregon representatives and dealers of Delco-light was held recently at the Multnomah Hotel, Portland. E. G. Byrne, salesman-engineer of the Delco-Light factory at Dayton, Ohio, who is on his way to the Orient in the interests of the company, was the principal speaker at the conference. E. H. Epperson of Seattle, western sales manager, was another speaker, and a general business discussion was held.

Personal Items —

W. H. Green has been appointed Pacific Coast manager of the Chicago Fuse Manufacturing Company with headquarters in San Francisco.

G. B. Kirker, railway engineer from Los Angeles, and **A. W. Eshelby,** railway engineer from Seattle, both of the Westinghouse Electric & Manufacturing Company, have been recent visitors in San Francisco.

W. W. Flanders, formerly manager of the Puget Sound Gas Company at Everett, Wash., has been appointed general superintendent of the Tacoma Gas & Fuel Company.

Curtis M. Lindsay, whose promotion to the position of manager of advertising and sales promotion of the Edison Electric Appliance Company, Inc., has recently been announced, and **Walter M. Fagan**, the newly appointed sales manager of the Hotpoint Division of the company, are both well known on this coast and their appointment is of unusual interest to the electrical industry in the West. Mr. Lindsay is a graduate of the electrical engineering department of Armour Institute, class of 1909. After a period of engineering field work with the J. G. White Company, he joined the forces of the Hotpoint Electric Heating Company, Ontario, California, in 1912, becoming connected with the sales promotion department. Two years ago he came to Chicago as assistant to the Eastern sales manager of the Hotpoint Company and for the past year has been sales manager of the Hotpoint Division of the Edison Electric Appliance Company. Mr. Lindsay has been identified with the Hotpoint sales and advertising campaigns since he started with that company, and his experience makes him especially fitted or his work. Mr. Fagan, a native of California, is nationally known in the electric range field, through his energetic work as sales manager of the Hughes Electric Heating Company and in a similar capacity with the Hughes Division of the Edison Electric Appliance Company, Inc. He has an exceptional grasp of the sale of electric heating appliances, electric ranges, and the utilization of electrical energy for heating and cooking purposes.

C. R. Dederick, representing the Square D Company, Detroit, and making headquarters at Portland, spent the week of February 17th in Seattle.

A. A. Miller, manager of the railway and power department, Westinghouse Electric & Manufacturing Company, Seattle, made a business trip to Spokane recently.

W. D. B. Alexander, president of the Adams Bagnall Electric Company and of the National Screw and Tack Company of Cleveland, Ohio, is in California for about six weeks' stay.

G. A. Richardson, general superintendent of railway, Puget Sound Traction Light & Power Company, Seattle, has gone to New York to make a report for the Brooklyn Rapid Transit Company.

E. J. McIlraith, superintendent of way and structures, Puget Sound Traction Light & Power Company, is in Chicago working with Stone & Webster on the appraisal of the Chicago surface lines.

John V. Painter, general manager of the Appleton Electric Company of Chicago, who has been visiting the Pacific Coast trade during the past month, has returned East via Salt Lake City.

J. G. Bourus, formerly manager of the Olympia Gas Company at Olympia, Wash., has been appointed manager of the Puget Sound Gas Company at Everett, Wash., succeeding W. W. Flanders.

Harry W. Dryden, of the General Electric Company from Schenectady, has been a recent San Francisco visitor.

Elmer Dover, formerly manager of the Byllesby interests in the far Northwest, has resigned and has gone into business for himself.

W. G. Lord, formerly chief electrician of the Arkansas Valley Railway Light & Power Company, Pueblo, Colo., has been appointed superintendent of the Pueblo division, succeeding C. A. Orr, resigned.

Maj. Ainslee A. Gray, who has recently received his discharge from the army, has opened offices in Chicago under the firm name of A. A. Gray & Company, to handle advertising in trade, technical and national papers.

A. W. Eshelby of the railway department, Westinghouse Electric & Manufacturing Company, Seattle, has returned from a two weeks' trip to San Francisco, where he was in conference with Westinghouse railway men.

F. W. Rust, formerly with the Rainier Electric Company of Seattle, has opened offices in the Seattle National Bank Building and is prepared to do electrical contracting. The new firm is known as F. W. Rust and Company.

P. S. Turner, manager traction department, British Westinghouse Company, and **Mr. Raworth**, electrical engineer with the Southeastern & Chatham Railway in England, were in Seattle recently for the purpose of inspecting steam railroad electrifications.

C. A. Winder, in charge of industrial heating for the General Electric Company with headquarters at Schenectady, N. Y., is a recent Pacific Coast visitor. Mr. Winder speaks most enthusiastically of the tremendous possibilities of this growing industry throughout the West.

Oliver Dowdell, of the Solano Supply & Construction Company, Suisun, Cal., is making some extensive improvements in his place of business, taking the building next door. His present room will be devoted to the sale of household appliances and the new one to his Willard service station.

B. A. Wagner, manager Electric Agencies Company, Inc., has returned to San Francisco from a trip East. As new representation secured for his company on the Pacific Coast he reports the Collyer Insulated Wire Company, manufacturers of rubber covered and weatherproof wire, and the Tubular Woven Fabric Company, manufacturers of "Duraduct."

D. J. Butts, formerly local manager of the Los Angeles branch of the Western Electric Company, has been transferred to headquarters in San Francisco and will in future have charge of certain specialties in the entire Pacific Coast district. Mr. Butts is succeeded in Los Angeles by **H. L. Harper**, who was formerly sales manager of the Kansas City branch of the Western Electric Company.

R. F. Behan, formerly chief assistant to the Pacific Coast manager of the Westinghouse Electric & Manufacturing Company, is now with John A. Roebling's Sons Company with headquarters in San Francisco. Mr. Behan has a wide acquaintanceship among men of the electrical industry throughout the West and he carries with him a host of good wishes in his new field of endeavor.

Captain J. H. Moseley, formerly on the advertising staff of the Journal of Electricity and later with the Texas Power & Light Company, has been appointed assistant to Mr. P. H. Thompson, advertising manager of the Western Electric Company. Men of the electrical industry in the West will recall the effective work of Mr. Thompson on many occasions looking toward the selling of the electrical idea as a whole, irrespective of selfish company interests, and his appointment of Mr. Moseley, a young man of broad experience and high ideals, is believed to be in full keeping with this progressive policy.

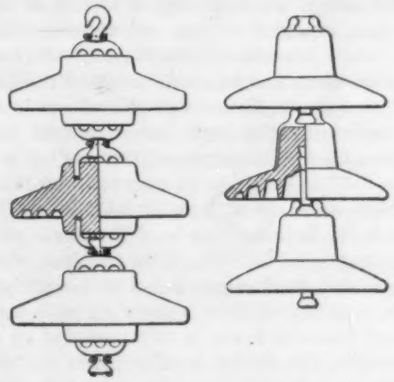
LATEST IN EVERYTHING ELECTRICAL

(A new circuit breaker which meets the needs of the electrified transcontinental railroad, a line of receptacles and plugs especially designed for marine use, a farm lighting and power outfit which is practically automatic, and a new type of high tension insulator which promises to solve many of the weaknesses hitherto thought unavoidable in such supplies are among the new electrical devices here presented.—The Editor.)

HIGH TENSION INSULATORS

The present type of suspension insulator has caused extremely serevere trouble, according to a recent article in the Electrical World, and despite the many improvements which have been made and suggested it appears that the insulator will retain certain inherent weaknesses. A new insulator of this type has been put on the market, however, which promises to become a serious competitor to the suspension insulator now in use, as it embodies many important features. This is the type of insulator which the Jeffery Dewitt Insulator Company has been developing.

The advantages of this new suspension insulator may be summarized as follows: (1) the disk is of extremely heavy bulk and accordingly should resist power-arc destruction.



(2) The design is such that temperature changes should have very little effect. (3) The iron spider is cast into the porcelain body by means of some low-melting and comparatively soft alloy which should act as a damper of shocks. (4) The electrostatic field is so nearly ideal and the puncture thickness between electrodes so excessive that the unit should be puncture-proof with porcelain of fair quality.

The mechanical strength of the unit is somewhat lower than that which is obtained from the ordinary type of suspension unit, but it offers, on the other hand, the advantage that its guaranteed strength can be verified on each unit before leaving the factory. This cannot be done on the cemented insulator.

Baker-Joslyn Company of Los Angeles, San Francisco and Seattle have been appointed Pacific Coast distributers of these insulators.

SAFETY CARS IN PORTLAND

The first of the 25 Birney safety cars have been put into service by the Portland Railway Light & Power Company. It is a light car mounted on a single truck, seats 32 people and is operated by one man. The axles have ball bearings and the power is ample with equipment devices that make it a speedy car in operation, picking up speed more quickly than a heavy car and quickly coming to a stop. The safety features are especially calculated to overcome the objections that are sometimes urged against a one-man operation of street cars. The operator's hand must be on the control or his foot on another control lever to keep the car in operation. When levers are free the brakes are automatically applied, the motor stops, sand pipes are open and when the car halts the doors are opened. The door control is by air pressure, operated by a device on the control lever of the motor.

FARM LIGHTING AND POWER

The Western Electric Company has gotten out a direct connected farm lighting set which is of all around serviceability and simplicity. The set is practically automatic throughout—as much as any mechanical power outfit can be made. At every point it was designed for the convenience of the user as well as for the service it gives.

The generator of the set is specially designed and the engine operates in such a manner as to give a tapering charge to the battery. This tapering charge allows just the right amount of current to flow in the battery. When the charge is completed the engine is automatically stopped by the little device on the control panel.

In addition to the tapering charge given regularly to the battery an occasional soaking charge is provided for by the battery switch. This combination of tapering charge and periodic soaking charge offers a dual-control of battery charging and is the best method for charging a battery. The dual-control method gives longer life to the battery.

This set is more than an electric light plant. It can be used as an engine alone. The 4 in. pulley on the main shaft may be belted to line shafting or other machinery and run independent of the rest of the plant.

The entire outfit stands about 4½ ft. high and occupies approximately 30 to 40 sq. ft. floor space.

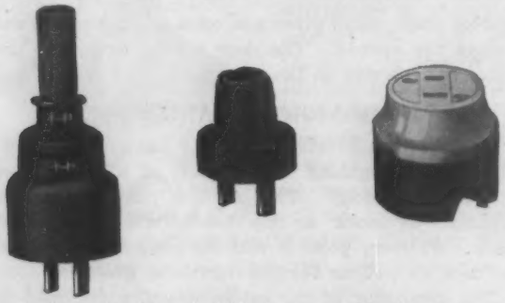
Type and Size	Watt Hour Capacity of Battery, Eight Hour Basis
15—DC—90	2700
15—DC—180	5400

Explanation of code number: The first figure expresses capacity of generator in hundreds of watts. The letter indicates the direct connected set. The last figure expresses the capacity of the battery in ampere hours (8-hour rating). Thus 15—DC—90 means 1500 watt generator, direct connected set and a 90 ampere hour battery, rated on the 8-hour basis.

BRYANT PLUGS AND RECEPTACLES FOR MARINE USE

The receptacles and plugs shown herewith are well known Spartan standard interchangeable type, but properly adapted for marine use where non W. T. extension cord outlets are desired in officers' quarters, mess rooms, cabins and state rooms.

Bryant Spartan interchangeable N. W. T. Marine Plug type receptacles offer a distinct advantage, because of the fact that they fit the plugs which are furnished with every



fan motor, practically all table lamps and other current consuming devices.

The base of this plug receptacle is unbreakable composition, as used on all other Bryant marine devices, the top section is hard white porcelain, glazed. This receptacle, catalogue No. 123, has a bottom diameter of 1¾ in., top diameter 1⅝ in., height 1 13/16 in.; a groove of ample size is provided in the base for wires to pass through or to allow wire entrance from the bottom of the box. Brass fastening screws 6/32 are furnished and kept in place by holding washers. Screw centers are 1⅜ in., which is the standard for all Bryant marine devices.

The K. D. cap is intended for use on small flexible cords not over 13/32 of an inch in diameter. For heavy insulated or metal armored cables up to 9/19 in. in diameter, the M. K. cap is best suited, as it is provided with a strain relief clamp and cord grip. Both of these caps are made of unbreakable composition and will stand severe usage.

NEW HIGH SPEED CIRCUIT BREAKER

High speed circuit breakers involving unusual characteristics have been developed and placed in operation by the General Electric Company to protect the generating apparatus in the Chicago, Milwaukee & St. Paul substations from flashovers resulting from short circuits near the stations. It is the function of this apparatus to operate with sufficient speed to check the rise in current caused by a short circuit before damage can be done to the converting equipment. In order to meet this requirement, it is necessary that the rise in current be checked within a few thousandths of a second and the circuit breaker described below meets these conditions in every respect. The rate of acceleration on the main and secondary contacts is approximately 8000 ft. per second and they are released in a time as short as .003 second or less from the beginning of a short circuit. The time from the beginning of the rise in current caused by a short circuit until the secondary contacts part, has shown by test to be of the order of .004 second. This compares with about .10 to .15 of a second, the speed of ordinary switchboard type breakers.

It has been the practice on many railroads to install a certain amount of feeder as resistance between the substation and the tapping-in point usually by carrying out the feeders to some distance from the station before tapping in. It was evident, therefore, that if apparatus could be developed to protect the generators from liability of flashover on severe short circuits, it would permit of the feeders being tapped directly to the trolley at the substation, thus eliminating the losses due to feeder resistance.

Preliminary calculations in connection with the electrification of the Chicago, Milwaukee & St. Paul Railway showed that quite an appreciable amount of power could be saved each year by the elimination of this extra feeder resistance. Work was therefore initiated on the development of an air circuit breaker which would have such a high speed in opening that it could be used to insert resistance in the circuit soon enough to prevent the short circuit current from reaching such a value as to cause the direct current machinery to flash over.

One of these breakers is installed in each substation and connected into the negative return circuit between the ground and the negative bus. This location would give the maximum protection since the return circuit must pass through the limiting resistance in case of a flashover from the positive to ground as all of the negative terminals, bus rigging, etc., are insulated for full generator voltage. To insure complete protection the high speed breaker is so interlocked with the regular switchboard type of air circuit breaker that the high speed breaker must always be closed before the switchboard breakers.

The fourteen 3000 volt direct current substations on the Chicago, Milwaukee & St. Paul Railway are equipped with this new type of breaker and the first units installed have been in operation since early in 1917 with very satisfactory results. All substation feeders are tapped to the overhead trolley system directly at the substation, eliminating the resistance losses occasioned by tapping at some distance away. Actual operation has demonstrated that it is entirely practicable to operate direct current stations in this manner when protected by the high speed circuit breaker, even though the voltage of the system (3000 volts) is the highest d.c. voltage used in commercial railway work.

The high speed circuit breaker installed for the Chicago, Milwaukee & St. Paul Railway is of the single pole, magnetic blowout type rated 3600 volts, 3000 amperes, direct current. The breaker and mechanism for a self-contained unit are mounted on a structural iron framework with cast iron base. The base and framework are in turn mounted on an insulated base to insulate the circuit breaker from the station floor. The operating mechanism is so arranged that the breaker can be closed either by hand at the breaker or by a motor controlled from the station switchboard. The closing of the breaker by means of the motor is accomplished by a cam mechanism operated through gears. When closed by hand, a ratchet mechanism is used.

BOOK REVIEW

Public Utility Reports Annotated

Decisions of the Public Service Commissioners and of the State and Federal Courts. Size 6½ by 9½ in.; 1132 pp.; cloth binding. Published by the Lawyer's Co-Operative Publishing Company, Rochester, N. Y., and for sale by the Technical Book Shop, 171-173 Second St., San Francisco. Price $5.00 per volume.

Many public commissions do not print decisions currently and they are not conveniently available until the annual or biennial reports are issued. For the convenience of public utility men and those associated in the industry, the reports of all cases coming before the public service commissions of the country and of the state and federal courts have been issued currently in pamphlet form by the Lawyer's Co-Operative Publishing Company and later gathered in volume form for convenient reference use, six volumes to a year. All important cases which record the growth and development of the public utility laws are given in full. Cases of less importance are abstracted and all are supplemented by annotations covering decisions prior to 1915. The value of the books is greatly enhanced by the careful analysis and indexing of all information in each decision. The reports constitute perhaps the most important source of information available to engineers and utility lawyers.

NEW ELECTRICAL DEVELOPMENTS

(An underground system is suggested for Vancouver, B. C., the use of power for irrigation projects is being greatly extended in the Pacific Central region, the Southern California Edison Company contemplates extensions in the Kern country—and the western tendency toward an engineers' licensing law has extended to Nevada.—The Editor.)

THE PACIFIC NORTHWEST

CENTRALIA, WASH.—The total receipts from the municipal light plant for 1918 show that the revenues were $35,595.13. Expenditures totaled $30,233.88.

PROSSER, WASH.—Pacific Power & Light Company has plans under way which include rebuilding practically its entire system here before fall. The Benton Independent Telephone Company will also rebuild its down town system.

VANCOUVER, B. C.—In the annual report of the minister of public works, the suggestion is made that the matter of an underground system of transmission lines in the city, which has been held in abeyance until the end of the war, be reopened for consideration.

SEATTLE, WASH.—Appropriations aggregating $55,000 to finance preliminary investigations as to the feasibility of the Skagit river power project, bringing the total expenditures for this purpose to date to approximately $135,000, have been authorized by the city council.

SEATTLE, WASH.—No bids were received by the city for the purchase of $750,000 municipal light and power bonds. These bonds are the first of an issue of $1,755,000 authorized by the council November 18, 1918, for extensions and betterments to the city's lighting plant.

EVERETT, WASH.—This place is to be given a chance in the near future to vote on the question of establishing a municipal light and power plant. The city commission has been quietly planning for several months for the development of power on the Sultan river, the first unit to call for 6,000 horsepower.

OLYMPIA, WASH.—Acting Governor Hart has approved of Senate Bill No. 18, the act under which the public service commission is authorized to exceed the five cent limit on street car fare within city limits. City councils are given the same authority over municipally-owned lines. The bill carries an emergency clause.

SEATTLE, WASH.—That there is a deficit of $73,082.60 in the funds appropriated for the construction of the municipal elevated street railway from First avenue South and Washington street to West Spokane street bridge over the West Waterway, was reported to the city council recently by A. H. Dimock, city engineer.

OLYMPIA, WASH.—Sealed bids will be received up to 5 o'clock p.m. March 4, 1919, by Hiram Dohm, city clerk, for furnishing the city with an electrically-driven centrifugal pumping unit, said unit to deliver not less than 800 gallons per minute of water against a 225-foot head, motor to be a 440 volt, 60 cycle, three phase.

OLYMPIA, WASH.—In the report of the hydraulic engineer recently presented, a recommendation for the further development of Washington's power resources is made. At present, the report says, only 257,415 kilowatts of power are being developed, while the state has potential power sites that will develop more than 5,000,000 horsepower.

SEATTLE, WASH.—Mayor Hanson and President A. W. Leonard have signed the contract for purchase by the city of the lines of the Puget Sound Traction Light & Power Company, also the contract by which the city agrees to purchase power from the traction company until such time as the city is able to supply its own power. The city will not come into possession of the property until the Supreme Court passes on the question of the legality of the transfer.

SPOKANE, WASH.—Announcement has been made of the purchase by the Washington Water Power Company of the Spokane Heat, Light & Power Company for a consideration reported to be $1,500,000. The Spokane Heat, Light & Power Company is in the hands of a receiver and consummation of the details of the sale must come through the federal court.

KLAMATH FALLS, ORE.—Consulting Engineer D. C. Henny and George W. Oldfield, president of the Water Users' Association, have made an appraisement of the Ankenny canal and power site from the upper lake to the Leavitt place, the purpose being to submit to the Secretary of the Interior a figure at which this property can be disposed of to anyone who may desire to purchase.

ASTORIA, ORE.—This place has been practically assured of a new light and power plant to take care of the industrial growth of the city. President McArthur of the Pacific Power & Light Company announces that the subject matter has been carefully considered and that definite plans will be presented to the stockholders in New York at once for an immediate decision.

RENTON, WASH.—W. A. Clench, secretary-treasurer Pacific Electric Welder & Manufacturing Company with works here, states that the company's representative in Australia, George H. Dowsing, reports that welder shipments to that country are steadily increasing. The company has shipped fourteen welders to date to Australia and Mr. Dowsing states further that many Australians contemplate engaging in the manufacturing business in the near future, including shipbuilding.

THE PACIFIC CENTRAL DISTRICT

VACAVILLE, CAL.—The Vacaville Water & Power Company has incorporated for $450,000. T. L. Gates, W. E. McBride and Susan W. Inglish are the members of the corporation.

STOCKTON, CAL.—The General Motors Company is contemplating the establishment of an additional large plant for the manufacture of tractors, trucks and farm implements at Stockton.

PORTERVILLE, CAL.—S. G. Winch of San Jose has awarded W. D. Baker the contract to install a 15 h.p. electric pumping plant on the Winch orange grove at Plano. The plant is to cost about $3500.

FRESNO, CAL.—The Railroad Commission recently gave the San Joaquin Light and Power Company authority to issue notes in the amount of $96,500 for the purpose of renewing notes held by eleven banks in the San Joaquin valley.

QUINCY, CAL.—Pember S. Castleman of Brandy City has made application for permission to appropriate 400 cubic feet per second of the waters of the North Fork of the Feather river for power purposes. Estimated cost of the proposed diversion works is $85,000.

TRACY, CAL.—A deal has recently been closed whereby the Toyo Industrial Corporation becomes the owner of the Vernalis Irrigated Farms, consisting of 2700 acres and situated on the river road southeast of Vernalis. The new owners will install a much larger irrigation system.

SAN FRANCISCO, CAL.—To avert a serious power shortage and threatened curtailment of development in the

San Joaquin Valley, the State Railroad Commission has authorized the San Joaquin Light and Power Corporation, which plans to spend $3,000,000 for improvements this year, to add a 15 per cent surcharge to all bills. The surcharge period is limited to January 15, 1920.

OROVILLE, CAL.—B. L. McCoy has been employed by water users to ascertain the possibility of increasing the irrigation supply of the Bangor district. He will learn the impounding capacity of a reservoir site on Honcut creek, near Sugar Loaf Mountain. It is understood that the use of the reservoir will require some pumping.

STOCKTON, CAL.—During the year 1918 the Stockton division of the Western States Gas & Electric Company added 1,090 electric consumers to its lines. There was an increase of 7,063 horsepower in connected load, of which 5,339 horsepower represents the increased load in motors.

ANDERSON, CAL.—The preliminary work on the building of the Hoover Creek tunnel has been started by the Happy Valley irrigation district. The tunnel will be about one and one-fourth miles long and will cost about $87,000 to build. It is expected to take about one year to finish the tunnel, and when finished it will be one of the finest and most strongly constructed passways in the United States.

WATERFORD, CAL.—The board of directors of the Waterford Irrigation District has instructed Chief Engineer Everett N. Bryan to purchase from the Sierra and San Francisco Power Company the use of 60 cubic feet of water from the flow of the Tuolumne river at La Grange, Cal., and to construct certain canal extensions, bridges, siphons and spillways designated by him as necessary new construction.

REDDING, CAL.—The Pit River Power Company is buying more land along Pit river to round out its two great power developments. A deed recorded shows that the Noble Electric Steel Company of Heroult has transferred 240 acres to the power company for $2500. The tract is on the south bank of the river and is one mile down stream from the mouth of Potem Creek. It is four miles northwest of Round Mountain.

HANFORD, CAL.—The Mount Whitney Power and Electric Company operating in Tulare, Kern and Kings counties, has applied to the State Railroad Commission for authority to collect a 15 per cent surcharge from its consumers of electrical energy, saying the 10 per cent surcharge authorized several months ago by the commission does not provide adequate return on its property investment of $5,313,000.

TERRA BELLA, CAL.—Plans for additional water supply for the 1919 season and for sundry improvements of the irrigation works have been worked out. Two more deep wells are to be drilled. Additional runners are to be placed in some of the pumps at the wells and at the booster station to increase supply and delivery of water. Additional service is to be provided at some of the high lands at the east end of the district.

WOODLAND, CAL.—A large increase in irrigation area in Yolo county during 1919 is indicated by the fact that the Pacific Gas & Electric Company has already made arrangements for carrying an additional load of 3000 horsepower for the purpose of operating irrigation pumps. Among the larger pumping operators will be the Alameda Beet Company, the Sutter Basin Company, the Conaway Tract and Reclamation District 107.

MONTEREY, CAL.—At the council meeting City Attorney Treat, in making a report on the rate hearing case of the Coast Valleys Gas & Electric Company, made the statement that the company will put in a current regulator here at once. This instrument, which will cost about $5,000, will regulate the current and prevent the very decided rise and fall in voltage which is so disastrous to lamps and other electric equipment.

UKIAH, CAL.—The Snow Mountain Power Company, which generates electric energy in Mendocino county and sells current to the Pacific Gas & Electric Company for use in this section and other portions of the state, is planning a large storage reservoir for its hydroelectric plant, and in pursuance of plans which have been under way for some time, has applied to the State Railroad Commission for permission to sell 7000 shares of stock.

VALLEJO, CAL.—Vallejo is to have an improved service in the way of electric lights. The consumption of electricity from the company's lines has been increasing for months past. To guarantee an almost continuous service, work has already been started on the building of a duplicate transmission line from the North Tower station of the Pacific Gas & Electric Company to the local company's central distributing station at the foot of Kentucky street. The cost of the improvement will be about $10,000.

SAN FRANCISCO, CAL.—As a result of the negotiations for the reorganization of the Oakland, Antioch and Eastern Railway, the Oakland and Antioch Railway and the San Ramon Valley Railway, which have extended over a number of years, a new corporation to be known as the San Francisco, Oakland and Sacramento Railway is to be formed to take over the properties of the reorganized companies, announcement to this effect having been made.

FRESNO, CAL.—Fresno Irrigation District, containing 240,000 acres and with more than 4000 land owners, is being organized. Improvement of the irrigation service 50 per cent, covering more land with a greater supply of water, the placing of the water service in public instead of private hands and the making possible of the $9,000,000 Pine Flat reservoir project whose dam will secure the irrigation of in excess of a million acres, are some of the results expected of cooperative ownership.

PORTERVILLE, CAL. — Announcement is made by A. J. Bolin, the head of a Kansas City syndicate, that work is to be started in the near future on the development by them of a 1000-acre orchard and vineyard property. It is stated by the owners that the tract is to be leveled, irrigation system installed and vines and trees put out as rapidly as they can be secured.

BAKERSFIELD, CAL.—The Southern California Edison Company will improve its properties in the San Joaquin Valley, according to papers filed with the application of the company to sell securities to the amount of $16,000,000. The company now has a power plant in Kern River canyon, built at a cost of several million dollars, which was completed in 1907. Two years ago they applied for permission to divert water for another large dam on the same river. This work, it is estimated, will cost several million dollars and will be started during the present year.

STOCKTON, CAL.—Indications that a joint pole agreement will be submitted to the trustees of Martinez were seen recently in a meeting held at the offices of the P. P. & E. at which representatives of the three companies interested were present. There was also present a member of the "joint pole commission" which is an independent body and which is appointed by agreement between the power companies of the state. This is in response to a notice from the city trustees served on the power companies, stating that it was the intention of the board to order all lines underground when the new streets were laid.

THE PACIFIC SOUTHWEST

HUMBOLDT, ARIZ. — The Humboldt Improvement Company is contemplating the construction of an electric light plant and waterworks system, to cost about $200,000.

FLORENCE, ARIZ.—Plans are being prepared by Burns & McDonnell, consulting engineers, Inter-State Build-

ing, Kansas City, Mo., for improvements to the municipal lighting system waterworks, to cost about $80,000.

SUPERIOR, ARIZ.—A company has been organized, to be known as the Superior Electric Power Company, to construct and operate an electric plant in Superior. The company is capitalized at $100,000. James O'Connell of Superior is president.

BRAWLEY, CAL.—A bond issue will probably be issued by the Imperial Valley Gas Company for the purpose of establishing a holder at Brawley in order to provide sufficient storage capacity to do away with the shortage as complained of by the city.

IMPERIAL, CAL.—The Holton Power Company is clearing the site of its old building recently destroyed by fire to make room for a new concrete building, work on which is to be started within 30 days. The new substation will cost about $6,000 and will be fireproof.

SAN DIEGO, CAL.—The La Jolla electric line has been incorporated with $250,000 capital stock to purchase part of the right-of-way of the abandoned La Jolla Railway from Bird Rock to La Jolla and construct an electric line to connect with the Mission Beach electric line. The project will cost $108,000, of which $54,000 will be paid to the old La Jolla company for track.

LOS ANGELES, CAL.—Plans for removal of tracks from that portion of Harbor Boulevard, between Fourth and Sixth streets in Pedro Heights, and the construction of a handsome new passenger station on the east side of the Boulevard between Fifth and Sixth streets, were laid before the Harbor Commission by the Pacific Electric Company. It is estimated that the new station and relocation of tracks will cost $50,000.

LOS ANGELES, CAL.—An application has been filed with the California State Water Commission by George I. Lamy of Los Angeles for permission to appropriate 120 cubic feet per second of the waters of Lake Elsinore, in Riverside county, for the irrigation of 20,000 acres of land. Diversion works are to consist of an open canal partly lined with cement, the main conduit to be forty-two miles in length. The work is to cost $700,000. A similar application for the use of the waters of Lake Elsinore for power purposes has been filed by Lamy, who states that the work will cost $300,000.

THE INTER-MOUNTAIN DISTRICT

KALISPEL, MONT.—The council has adopted a resolution providing for twenty-nine lighting districts in the city.

SALT LAKE CITY, UTAH.—The Bamberger Electric Railroad Company is considering the purchase of one automatic substation equipment to convert present manual control.

HELPER, UTAH.—The city council is planning to rebuild penstock and intake works for the hydroelectric plant, recently destroyed by flood. The cost is estimated at about $10,000.

GARDNERVILLE, NEV.—The Douglass Milling and Mining Company are making provisions to install another hydroelectric unit of 150 kw. capacity. They operate in and around Gardnerville.

MANTI, UTAH.—Plans are being considered by the city council for extensions to the municipal electric system, including enlarging the present flume, extensions to the distribution system and construction of a hydroelectric plant, to cost about $10,000.

FORT COLLINS, COL.—Bonds to the amount of $100,000 have been voted for the purchase of the local street railway system, owned by the Denver & Interurban Railway Company. Of this amount $75,000 will be used to pay for the railway and $25,000 for improvements to the system.

CARSON CITY, NEV.—A bill is being introduced into the legislature to register professional engineers. The bill as proposed is not mandatory in its provisions, as anyone can practice engineering without being registered.

BURLEY, IDA.—Cottages at Minidoka Dam and pumping station were completed last month. Some concrete structures were repaired and installed. The bunk houses at the Second Lift pumping station was repaired, and work was begun on a new barn there.

PROVO, UTAH.—It is reported that construction of the Soldier Summit-Strawberry railroad will begin in the spring. An agreement between the railroad and the Utah Light & Power Company of Salt Lake has been effected. As the result the railroad will be an electric line.

MOSCOW, IDA.—The proposal to install a municipal electric light and power plant is awakening much interest. The committee appointed by the council to investigate the feasibility of the plan is getting figures on the probable cost of installation and operation and the amount of business that could be expected.

PHOENIX, ARIZ.—A municipal gas and electric plant is in contemplation at Tempe. A committee of citizens has been appointed to act with a committee from the city council to make necessary arrangements with engineers to procure plans and specifications for the proposed plant and bonding election to be voted upon by Tempe citizens.

OGDEN, UTAH.—The Emery Valley Reservoir and Coal Company and the state land board are making negotiations whereby the transfer and sale of the surplus storage rights owned by the State of Utah in the flood water of the upper Sevier river will be enacted. Approximately 100,000 acres would be watered by this surplus.

BRIGHAM, UTAH.—At a mass meeting held recently the city council was authorized to install a new street-lighting system, to cost about $12,000. The lamp poles now in the middle of Main street, from Third South to Forest street, will be removed and ornamental standards erected on either side of the street; also from Main street to First street West on Forest.

RENO, NEV.—A curious situation has developed here on account of the joint action of the Federal Government and the state in their efforts to exterminate "varmints." The results have been very good to the sheep and cattle industry and even to game, but the rodents also have benefited, and in many places it has about driven the farmer to distraction. One farmer claims a loss of $10,000 on his wheat crop.

PUEBLO, COLO.—Street railway business is reported unusually good. The Arkansas Valley Railway Light & Power Company shows an increase for the month of January of 15,000 passengers carried, over January, 1917, which was one of the best months in the history of the railway department. The company is receiving many applications for power in rural districts for irrigation purposes and from mine operators for operation of their mines.

BOISE, IDA.—Extension of the "underground district" of the city, whereby all overhead electrical construction is eliminated, is advocated by Fire Chief Foster in a recent report made to the city council. He is therefore recommending that the "underground district" as at present constituted be extended to take in all of the territory between the railroad tracks on the south, to and including Jefferson street on the north; from Sixth street on the east to Sixteenth street on the west, between the railroad and Main street, Fourteenth street from Main to Idaho, and Twelfth street from Idaho to Jefferson.

TAKING COUNT OF STOCK always reveals the fact that there are numerous small articles of considerable value whose existence has been overlooked. A perpetual inventory system in some measure obviates this difficulty. The Vacuum Cleaner department has been designed to meet a similar need, that is, to place on record those bits of conversation and incidental interest which otherwise might slip to the back of the shelf.—The Editor.

An American Celebration in Germany was the occasion of the program, of which a reproduction is made below. The printing establishment evidently possessed only the German type, with this result:

Programme

Christmas Entertainment

For the soldiers, by the soldiers and of the soldiers
314th Sanitary Train, 89th Division,
Army of Occupation, A. E. F.

Bitburg (Germany) -
7 P. M. December 24 1918.
Echternach (Luxembourg)
2 P. M. December 25 1918

Echternach (Luxembourg)
7 P. M. December 25 1918.
Bisenius-Weber
Hall, Rue de la Gare.

First comes a concert with ragtime galore
By the band from ambulance three fifty four:

Sad Sheets is Director, Dic Maul plays Cornet
Fallon plays Trombone, Floyd Gipple Clarinet
Wolff toots the Sax, And Mumford the "Stiv"
Croft blats the Bass, with an Iron-clad lip.
Mc. Candlish plays "Packhorn", And Walters Saxophone
Benebig the Bass Drum, And Weise Baritone
Frazell plays Alto, and Dreyer Cornet
And Taylor plays Snare drum and works up a sweat.

Next comes a minstrel by soldier boys brave
If dockstader could see he'd turn o'er in his grave
The four end-men niggers whose names are below
Will hand you a laugh all through the show:

„Canby" Cunnigham of whom you have heard
Wm. J. Nef is also some bird
F. Gale. Mogle is known very well
T. P. Sheridan can sing and rattle — — —

One of the performers of the occasion was young Frederick D. Galloway, son of a member of the Journal of Electricity's organization. He was only sixteen years of age on entering the army—probably the youngest boy who enlisted here in the West, but he made good. He was on the program of this occasion for a share in the minstrel show, where his tenor voice was evidently much appreciated.

More truth than poetry is contained in this little poem sent in by A. G. Wishon. The author is unknown but he evidently knew what he was talking about:

THE ENGINEERS

(Tune: "Son of a Gambolier")

Who is the man who views the mines and promptly turns them down?
Who is the one that thinks this is the short cut to renown?
Who is it gives the bum advice to the innocent financier?
The knowledge-feigning, theory-straining mining engineer.

Who steals our gold and silver, and copper, zinc and lead?
Who takes the joy all out of life and strikes our high hopes dead?
Who never wrote a schedule that to anyone else was clear?
The sulphur-belching, miner-welching smelter engineer.

Who is the man designs our pumps with judgment, skill and care?
Who is the man that builds 'em and keeps them in repair?
Who has to shut them down because the valve seats disappear?
The bearing-wearing, gearing-tearing mechanical engineer.

Who buys his juice for half a cent and wants to charge a dime?
Who when we've signed the contract can't deliver half the time?
Who thinks a loss of twenty-six per cent is nothing queer?
The volt-inducing, load-reducing electrical engineer.

Who is it takes a transit out to find a sewer to tap?
Who then with care extreme locates the junction on the map?
Who is it goes to dig it up and finds it nowhere near?
The mud-bespattered, torn-and-tattered civil engineer.

Who thinks without his products we would all be in the lurch?
Who has a heathen idol which he designates Research?
Who tints the cheeks, perfumes the air, and makes the landscape drear?
The stink-evolving, grass-dissolving chemical engineer.

Who is the man who'll draw a plan for everything you desire?
From a transatlantic liner to a hairpin made of wire?
With "ifs" and "ands," "howe'ers" and "buts" who makes his meaning clear?
The work-disdaining, fee-retaining consulting engineer.

Who builds a road for fifty years that disappears in two?
Who changes his identity, so no one's left to sue?
Who covers all the traveled roads with filthy, oily smear?
The bump-providing, rough-on-riding highway engineer.

Who takes the pleasure out of life and makes existence hell?
Who'll fire a real good-looking one because she cannot spell?
Who substitutes a dictaphone for coral-tinted ear?
The penny-chasing, dollar-wasting efficiency engineer.

—ANONYMOUS.

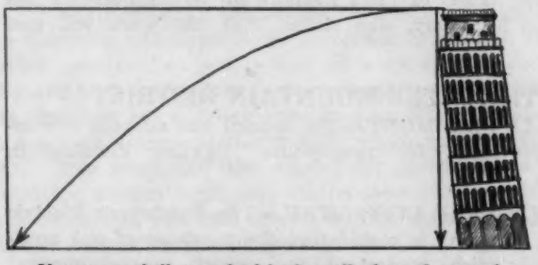
Electrocuting the Cootie is the subject matter of a letter recently addressed to the Editor by B. F. Jakobsen, consulting engineer of San Francisco, as follows:

Permit me to call your attention to what I believe to be a somewhat novel use to make of electricity and what might be termed "an attempt to electrocute body-lice in situ." Quoting from The Scientific Monthly February 1919 issue, article by Dr. O. L. Howard, Chief Bureau of Entomology, U. S. Department of Agriculture, page 116:

"By a special request of the Electro-Therapeutic Branch of the office of the Surgeon General of the army, investigations were made of a high frequency generator as a control means against the body louse, and as a result of these investigations suggestion was made as to the possible application of high frequency electric treatment for the control of scabies and other skin-infecting parasites. Cooperative investigations along this line are about to be taken up."

ENGINEERS OF YESTERDAY—4. GALILEO

(A Series Compiled by A. L. Jordan)



If a cannon ball were fired horizontally from the top of the leaning tower of Pisa (see diagram), and another were let fall at the same instant, which would strike the ground first?

In spite of appearance, both would arrive at the same time. The laws governing such actions were discovered by Galileo. His first experiment at the tower of Pisa was made in 1590 and showed that a 100 lb. shot and 1 lb. shot fell and struck the earth together. He also discovered (in the cathedral of Pisa) that the rate of a pendulum depends on its length rather than the magnitude of its swing, a fact upon which the value of a pendulum clock as a timekeeper depends. He invented one form of telescope, discovered the principle of the "parallelogram of forces" and other principles of mechanics. His teaching that the earth revolves about the sun antagonized the authorities and he was imprisoned for most of the remainder of his life.